ARMY ORDNANCE

VOL. XIII, No. 77 MARCH-APRIL, 1933

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What Price Arms Embargo?
An Editorial

A BIMONTHLY REVIEW OF AMERICAN MUNITIONS
PUBLISHED BY THE ARMY ORDNANCE ASSOCIATION, WASHINGTON, D. C.

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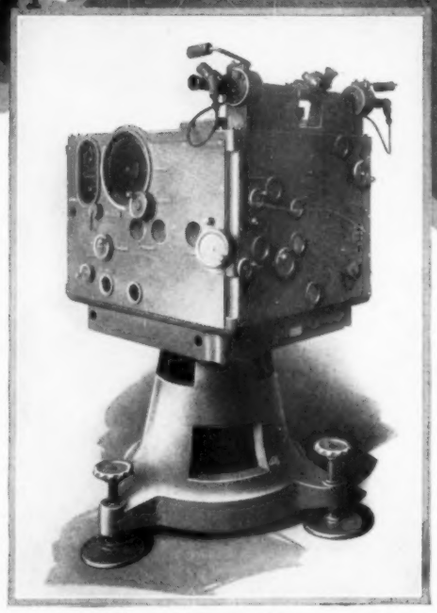

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ARMY ORDNANCE

The Journal of the Army Ordnance Association

Founded 1920

Pledged to Public Service in Effecting Industrial Preparedness for War as Our Strongest Guarantee of Peace

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Volume XIII **MARCH-APRIL, 1933** **No. 77**

CONTENTS

		Page
Hon. George H. Dern, Secretary of War		Frontispiece
The Loud Talk of Disarmament	By Hilaire Belloc	259
Preparedness with Restoration	By LeRoy Hodges	262
The Gerlich Rifle and Bullet	By Glenn P. Wilhelm	264
Brig. Gen. Colden L'H. Ruggles		268
Automatic Firearms	By J. S. Hatcher	269
The Ancient Cycle of War	By Hoffman Nickerson	275
An Effective Trench Mortar	By E. C. Goebert	281
A Plea For The Defense	By R. P. Gatehouse	285
Antiaircraft and Tank Practice in Germany (Pictorial)		289
American Military History	By C. C. Benson	290
Editorial		294
Ordnance and Job Relief—The New Commanders and the Old—Disarmament Plans Ad Infinitum—What Will the Cork-and-Needle Tactics Be?—Gloom on the Mechanized Front—International Debts and Territory—A Super Submarine—What Price Arms Embargo?		
Association Affairs		300
Samuel Kahn, San Francisco Ordnance District Chief—New Members—Necrology—Association Membership.		
Book Reviews		302
Index of Advertisers		315

"Certain patriotic citizens have realized the importance of adequate industrial preparation and have voluntarily organized to assist in this work. The Army Ordnance Association comprises such a group, upon which the War Department leans heavily in carrying on the many activities incident to this type of preparation."

Frederick H. Payne, former Assistant Secretary of War.

The Army Ordnance Association

THE Army Ordnance Association is a national organization of American citizens pledged to industrial preparedness for war as our nation's strongest guarantee of peace.

The Association endeavors to keep alive an interest in and knowledge of the design, production and maintenance of munitions. Other than a few manufacturing arsenals—six in all—there is no peace-time industry for the production of ordnance. Should war unhappily come again, industrial America will be called upon to produce munitions in great quantity and of intricate and unusual design. In an emergency time will not permit careful study or long preparation for the production of munitions. The problem is one of vital concern.

THE Army Ordnance Association believes that the solution of this problem, based on experience, lies in an active organization at all times coöperating with the Government. The principal objective of the Association is an active membership of American citizens, on whom the duty of design and production of munitions will fall in war, who will have an accurate and authentic knowledge of the complex requirements of ordnance. "Peace insurance" in this form is the foremost aim of the Army Ordnance Association.

The Association is purely patriotic; it has no commercial interests, no political alliances, and no religious affiliations. It is not operated for profit: its income is expended in furthering its aims. Its officers and directors serve without remuneration.

ARMY ORDNANCE, the journal of the Association, is published solely for the purpose of disseminating information on the progress of our munitions developments so that American industry may at all times know its responsibilities to the common defense.

The objectives of the Association as set forth in its Constitution are:

To assist in effecting industrial preparedness for war as being one of the nation's strongest guarantees of peace;

To keep available the highly specialized knowledge necessary for arming the manhood of the nation by stimulating interest in the design and production of ordnance material;

To promote mutual understanding and to effect cooperation with American scientists, inventors, engineers and manufacturers in civil life and the regular and reserve officers of the Ordnance Department.

To provide, when required, the services of competent committees to investigate and report upon special ordnance subjects;

To assist in developing and maintaining an efficient personnel, both commissioned and enlisted, for the units required for Ordnance Field Service in the event of an emergency;

To commemorate the services rendered by the industry of the nation and by the officers and civilian employees of the Ordnance Department in the wars in which the United States has been engaged.

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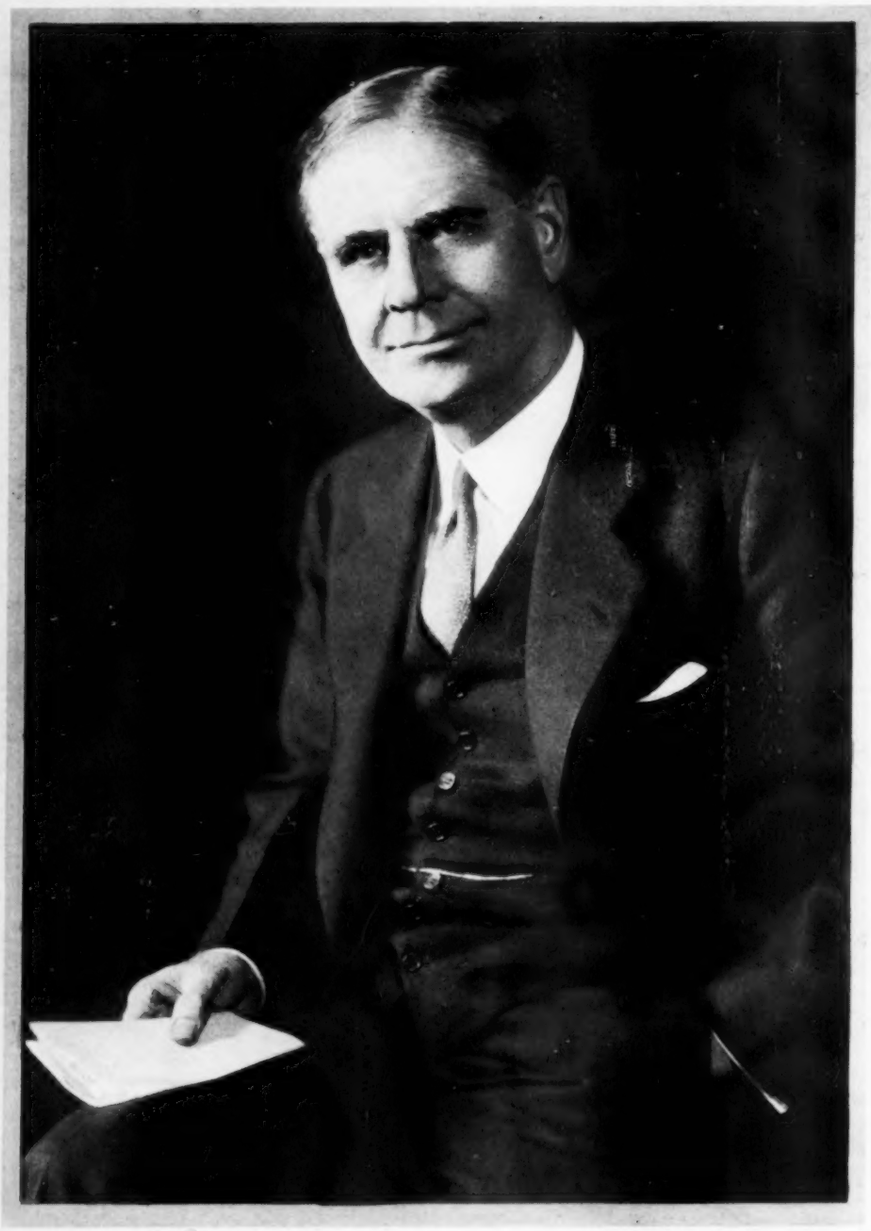

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Hon. George H. Dern

Secretary of War

ARMY ORDNANCE

Vol. XIII MARCH-APRIL, 1933 No. 77

The Loud Talk of Disarmament

A European Analyst, Knowing the Truth, Speaks It

By Hilaire Belloc*

I DO not know whether it may not be of service for observers in the United States to hear something of how the talk about disarmament appears to a European who is always amused by telling the truth and who has no doubts as to what the truth is.

In the first place the attitude of the European taxpayer and even of the European citizen in general (and in Europe only a minority of citizens really know that they are taxpayers) is that the cry for disarmament, the belief that it would enable nations to pay their debts to other nations, is a false cry. On this point the general view is imperfect. It is not wholly a false cry, because, obviously, money spent on armaments in any particular country capable of itself making armaments is simply a transference of wealth, that is of goods and services from one set of citizens to another; whereas the payment of debt to a foreign nation is direct loss of wealth; a payment out of the general wealth of the people to others: they will never see it again.

But this very simple argument is, I say, imperfect. There is to begin with the proviso I have just mentioned, that the argument does not apply to nations who have to buy their armaments abroad because they cannot make them themselves. There is also the fact that the armament firms may be largely owned by people living abroad (the profits of one great English armament firm are largely spent by a resident on the Riviera) and lastly there is the very telling argument that, although the money may remain in the country, it does not remain with the same people. The taxpayer, who has to support a large army and navy may be gratified to know that his money remains in the pockets of his fellow citizens, but it does not remain in *his* pocket—and he would much rather it did. In other words, armaments on the modern scale are a very real burden. They are clearly a burden when the payment goes outside the country because the nation cannot make its own armaments, or because its own armament firms are largely controlled by people living abroad, and it is also a burden (though of another kind) even when all the money is spent in the country. Industrially independent nations such as the French and the English insist that the payment for armament be spent within the country, to cease it would not make them any better able to pay debts to foreign governments. But that does not apply to the lesser nations or to those less well equipped industrially.

So much for the argument, which was always a weak one, that disarmament today would enable the international debtor to pay his international creditor, and especially enable the Western European nations to pay the United States the money they owe that country.

The second set of arguments used against disarmament in Europe is drawn from the very nature of human conflict. It is said that the cry for disarmament is unreasonable for two reasons. First, if men want to fight then they will fight just as much with the lesser or reduced armaments as they would have done with the more modern and expanded type of armament. Secondly, however much you reduce armaments in peace time, nations (the industrialized nations at least) could always begin the manufacture of the forbidden larger armaments during war.

THIS argument, like the financial one just mentioned, is imperfect. If one could really reduce armaments of a certain kind—for instance, if one could eliminate the poisoning and bombardment of the civilian population in open towns—war might lose something of its present intolerable horror and recover something of its glory. Again, although it is true that partly disarmed nations could, if they were industrially equipped, use during a war what had been forbidden them during peace time, yet the forbidding of certain instruments would at least put a brake on the first phase of a war and lessen its destructive character perhaps for a sufficient time to make a compromise possible.

There is finally this to be said for the disarmament cry—which must be admitted even by those who know that it is largely hypocritical and futile (unless there be a true international control)—that unless we curtail them, modern armaments may destroy not the human race indeed, but all the structure of our civilization, and that certain forms of disarmament would strengthen the defensive against the offensive, at any rate in the beginnings of a war. Let us consider those two statements.

It is obviously true, in Western Europe at least, that national war under present conditions, pushed to its extreme limits, would break down the structure of our society. Even those who are most convinced that the power of an attack from the air upon armies has been exaggerated, will admit that one can hardly exaggerate the effects of an attack from the air upon the great urban centers of Western Europe. If beyond the Hudson, in New Jersey and Pennsylvania, a wholly independent State had its own airborne fleet, who could guarantee New York? In Europe we have sovereign States elbowing each other after this fashion at somewhat larger distances, but distances in no way prohibitive, and moreover it is agreed that there is as yet no true defensive capable of meeting an aërial attack against a large modern town. The English could bombard Paris perhaps to its destruction, and cer-

*Author: Napoleon, Richelieu, Wolsey, Cranmer, James II, Joan of Arc, Danton, Marie Antoinette, Robespierre, History of England, Miniatures of French History, and many other historical studies, essays, etc.

tainly the French could bombard London to its destruction.

If it were possible to cut out certain forms of armament—the proviso is purely hypothetical—the threat to our civilization would be diminished. As it stands, that threat is, to our European nations, overwhelming. Any pair of us who stand side by side and are highly prepared for modern war, may be compared to two men each of whom can spring a mine under the other, each of whom is watching the hands of the other. Each on seeing the hand of his opponent move towards a certain switch will touch off his own mine, and the chances are that the explosions will be nearly simultaneous and both parties will be destroyed. It is this consideration more than any other which has emphasized the demand for disarmament among us.

BUT the second argument has weight also: the argument that if you could forbid certain forms of armament the defensive would be the stronger and therefore the danger of sudden aggression would be weakened. It is customary to say that you cannot distinguish between the offensive and the defensive for the ultimate purposes of war. That of course is true, if you are considering war pushed to its last conclusion. The resistance of a fortress may be vital to a plan for an offensive arranged to take place elsewhere, and nearly always the same weapon which enables you to resist attack can be used alternatively to press an attack.

Nevertheless it is true that at any stage in the history of the development of arms one could strengthen the defensive by the forbidding (if that were possible) of newly discovered instruments. For instance, the stone castle and walls of the Middle Ages were capable of a prolonged defensive. Not so much gunpowder as the use of newly perfected artillery, the power of delivering shattering blows quickly and successively on a small area of stone wall from a distance, broke down this old power of the defensive. It was reconstituted by the substitution of earthworks for stone walls, but in the interval between the beginnings of artillery in the early fourteenth century and its perfection in the sixteenth stone walls could prolong a defensive for many weeks and even months.

You have an excellent example of that in the interval between the gradual development of fairly accurate artillery in the early sixteenth century and the development of the earthwork towards the end of that century. During that interval stone walls went down like ninepins. Henry VIII of England turned himself into the absolute King of Ireland, from the vague mere "lord" which his father had been, by the use of his artillery and in particular the capture of Maynooth. Yet in England where the military art was slowly developed, the advantage of the stone wall lasted on into the middle of the seventeenth century. It was not until Cromwell's time that the castle and the walled town gave way for good and all. If by some miracle Christendom could have been got to forego the use of artillery in the sixteenth century, the defensive would have been rehabilitated.

In the same way today if you could absolutely forbid bombardment from the air and the use of poison (introduced by the Prussian staff in the late war) in any form, the defensive would clearly be strengthened; that is, the power of resistance at the beginning of a war against that which was economically or industrially stronger.

So much for the abstract arguments which, it may be said with great justice, are of little value in the world at the present time for two very good reasons. The world at the present time has not a common religion and a common moral system, and the world at the present time has not the intelligence to understand the problems which face it. But what about the concrete? What is meant in the concrete by this cry for disarmament in Europe? *That,* if you like, is indeed a practical question! To *that* I think an observer in the United States may turn with more profit than to a consideration of what are, after all, fairly obvious, and I am afraid fairly futile, ideal discussions. In the concrete the discussion on disarmament in Europe today is vitiated by falsehood.

THERE is also of course what is always present in human affairs, side by side with moral evil, ignorance—men are handicapped in their discussion of disarmament by their ignorance of what they are discussing, and that is particularly the case under parliamentary government, which has become something of a laughing-stock throughout our Western European nations. I sat in the English Parliament myself for five years. I have been a gunner on a very modest scale, have followed maneuvers regularly and have kept a standing interest in military affairs. I can testify the kind of men who come to the front under a parliamentary system are unworthy of being given the least control over armaments. If they had the humility to take the advice of those who know something about war, or had a sufficient capacity for judging men, or even a sufficient disinterestedness or judgment to pick out those who could advise them properly, it might be better. As it is our politicians are grotesquely ignorant of the military problems with which they have to deal, and from the nature of their trade, soon grow incapable of judging who could advise them. This ignorance is again a handicap of course in public discussions upon the matter. What this may mean to the United States I know not, but at any rate to us in Western Europe, where public opinion has very little to do with government, less perhaps in the sham parliamentary system than it would have under a saner state of affairs, the politician in war is a disaster. Anyhow the factor of ignorance is obviously there, and may be mentioned to begin with. It vitiates all the concrete proposals of practical discussion upon the point of disarmament.

But very much more important, indeed the point of capital importance in the whole affair, is this; that the religion of the modern man in Western Europe has been, for now long past, a worship of the nation: Ceasarism in its most extreme form. A new element has been introduced during the last generation, an element largely increased by the stress of the Great War, the element of class hatred; but still, nationalism remains the dominant religion. Now let it be remembered, for it is of vital importance to all political discussion, that religion is at the root of public affairs; it has been well said "Every war and every revolution is theological."

If the nation is that for which a man is willing to die; if treason to the nation is the unforgiveable thing; if the nation be what an earlier mood would have called "the Idol of our idolatry," then the nations discussing armaments amongst themselves, not overshadowed by any ideal of community amongst themselves, not having much love, for instance of the old ideal of Christendom, will necessarily, when they discuss disarmament, take refuge in falsehood. That is exactly what has happened in Western Euroupe. Each nation has played its own hand, and every effort at disarmament has

given a further proof of how futile it is to attempt a composition between units each of which regards its own survival alone as important and the destruction of others as indifferent.

Of this truth the best example I think is the attitude of our own people in Great Britain. We denounce without ceasing, and with the utmost vigor the submarine, and the use of bombardment from the air. We spend upon our armaments far more than any other European nation. Upon this we remain silent, but upon the intolerable wickedness of submarines and bombardment from the air, we are eloquent. The Italians in their strong new national state (it is increasing in strength and observers say that it is the best government in Europe) demand equality of naval armaments in the Mediterranean as against France, that is the disarmament of France by that margin of superiority which she possesses in that sea. To which the French reply that they have no objection to equality if only the Italians will be good enough to build up to the French standard—knowing well that they have not the means to do so.

Every nation, at least all those which are nationally conscious—and with us in Europe most nations have become conscious, and the Western ones have long been so—is playing for its own hand. An effort has been made at the establishment of an international force acting under an international code which would prevent the outbreak of war. It has been consistently blocked by the refusal of Great Britain to join such a scheme. Even if Great Britain were to join it, one may be certain that it would be inoperative when the moment of action came, because national feeling would be too strong.

THE truth is that there is no way out of our difficulties through disarmament. The only way out of our difficulties lies in the recognition of a common civilization, and a worship of this; a religion such as inspired Christendom during its resistance against the enemies who would have destroyed it between the fifth and seventeenth centuries. Of that there is as yet no sign.

Meanwhile there are two brakes upon the machine which is running headlong to the precipice. The first brake is that there is a very general consciousness that if war is permitted among us, we shall all perish. Although national feeling has fostered approaches to a new war—for instance, the strong support given to Prussia against Poland—yet when we come to the edge of the precipice, the terror of a new conflict would probably suffice to check it at the outset, or at any rate to bring overwhelming pressure against it after its first beginnings. Personally I believe there will be a Prussian aggression against Poland; at any rate, it is an even chance. But I doubt whether it will go far before England herself, and certainly Italy, will join France to put out the fire.

The second brake is of quite another character, it is that the Possessing Powers, who have most to lose and least to gain by war, are also the most powerful of the units involved: these are notably the French and the English. Were they to act together, as I think they would be compelled to act, if the danger of war became acute, they could prevent it; even not acting together, their interests are sufficient to give pause to those who would break the peace. It is a very poor safeguard, and the safeguard of fear is only one degree better. Still, such as they are, these two safeguards, the terror of mutual destruction, and the fact that the possessors of advantages happen to be stronger than their would-be despoilers, are the best guarantee we have for the maintenance of peace.

Perhaps some reader of mine more ingenuous than the ordinary, will ask me with some indignation, why I have made no account of the apparent enthusiasm for peace and the heartfelt cry for disarmament which has been heard now for so many years from our Press and our professional politicians. The answer is simply this—hypocrisy. Men love to pretend to good without having the trouble of doing it—to proclaim themselves the champions of good without paying the price of championship. A man who has not observed that obvious vice in mankind knows nothing whatever of his fellow-men or indeed of himself.

The loud talk of disarmament has meant nothing, because no one has really meant to disarm.

Our First Line of Defense.

Preparedness With Restoration

Educational Orders as a Priming Agency in Industrial Recovery

By LeRoy Hodges*

EXPANSION at this time of the War Department's peace-time arms and munitions educational orders plan into a rearmament and reëquipment program for the Regular Army and the National Guard as a priming effort in national industrial recovery would help relieve unemployment, create a demand for raw materials, stimulate allied industries such as steel and machine tools, help transportation, advance industrial efficiency and technological knowledge, bolster business morale, and be a timely and practical contribution to effective national defense.

Lieutenant Colonel Hodges

At the far end of such a program, the American taxpayers would have something of real and lasting value to show for the expenditure during this crisis of the funds required to put it into effect. It would lend itself to quick expansion to meet emergency military needs or to provide required reserve supplies. Most important of all, however, it would help underwrite peace by promoting the industrial preparedness of the United States in a sound and economical way.

Funds sufficient to enable the War Department to place an effective volume of "educational orders" with American industry at this time in connection with the rearmament and reequipment of the Army with up-to-date arms and munitions as a part of the new Administration's national restoration program of public works and internal improvements, reforestation, farm relief, bank stabilization, naval treaty tonnage building, and foreign trade revival, etc., would contribute tremendously toward industrial recovery and reduction of unemployment in the United States.

The educational orders plan, it will be recalled, was evolved by the War Department in 1922 in an effort to make the National Defense Act effective by providing a peace-time source from which an adequate supply of standard arms and munitions could be had promptly in cases of national emergency. The plan was first considered in Congress in 1927, but has been held back year after year on the grounds of national economy. It involves preparedness instruction of American manufacturing plants as well as their equipment to produce up-to-date arms and munitions promptly in case of need, and requires release, under proper safeguards, from existing requirements of competitive bidding in commercial procurement, and from restricted Government manufacture in production, of needed matériel. Extensive congressional hearings were held on this plan in 1929, and bills of authorization were introduced in the last Congress carrying limited annual appropriations for a five-year period which failed of enactment.

Educational orders were not designed to be a profitable source of new business for American industry, and they will not be even if applied as a priming element in a broader rearmament and reequipment program as part of the national restoration effort in the present economic crisis. American industry has already made heavy and unselfish contributions to industrial preparedness in spite of many handicaps since the World War.

IT has been said very aptly that the World War taught America that the factory is the ultimate battlefield where the final successful decision is made. Industrial preparedness, therefore, is a basic factor in any sound policy of national defense, and means peace-time planning and preparation for supplying modernized standard arms and munitions of superior quality in adequate quantities with minimum delay in times of need.

A cardinal principle of industrial preparedness is to solve the problem of how to provide commercial factories capable of conversion to specialized war production with the minimum training of personnel essential to maintain an active war industrial reserve unit with a minimum equipment of tools and machinery essential for a rapid conversion from commercial peace-time operations to expanded war-time production. As a solution of this problem, the War Department proposed the educational orders plan more than ten years ago. Educational orders were endorsed at the annual meeting of the Chamber of Commerce of the United States in 1928 "In order that industrial enterprise may in times of peace become familiar with munitions manufacture and be prepared to do its part in war production."

*Managing Director, Virginia State Chamber of Commerce. Author: Post-War Ordnance. State Ordnance Officer, Virginia National Guard. Lieutenant Colonel, Ordnance Reserve, U. S. Army.

Congress, however, has not yet sanctioned nor made appropriations for this plan, in spite of the fact that our surplus war matériel is now more or less obsolete, and our ammunition reserve left over from the World War is deteriorated and largely depleted. Our commercial factories have manufactured practically no ordnance or specialized military equipment during the past decade, and in most cases have scrapped their World War tools and equipment and allowed their trained workers to scatter, while the introduction of new standard matériel renders worthless such dies, jigs, and gages as they still may have on hand.

The pitiful state of American "preparedness" to enter the World War in 1917, in spite of the fact that a few of our basic industries received preliminary training by filling large Allied war orders for steel, arms and munitions and other supplies, in the early years of the conflict, must not be forgotten nor repeated in any future emergency. Without the experience which the execution of contracts for the Allies gave American industry, beginning as early as 1914, and which were in effect "educational orders," the World War might easily have ended in a very different way.

Take, for example, the case of an automobile manufacturer being asked by the War Department in October, 1917, to make gun recuperators without the firm knowing what a recuperator was, and without even samples or assembly drawings to guide them. It was nearly a year and a half after war was declared before the first recuperator under this contract was ready for delivery in spite of almost superhuman efforts on the part of the company to speed up production.

Another case of the hundreds that might be cited was the selection in 1917 of a manufacturer of precision machinery to make antiaircraft gun carriages. Instead of making delivery in six months in accordance with contract, it was eighteen months before the first carriage was finished. According to the president of the company, this delay was contributed to because the company had had no previous experience in manufacturing gun carriages; and was due in part to changes in design made after the order was placed, to some extent to the fact that requirements of interchangeability necessitated an extremely high degree of machining and finishing, and to the additional fact that all the required jigs, tools, fixtures and gages, numbering nearly forty-four hundred, had to be produced before manufacturing could begin.

Another factor which contributed to a very considerable extent to the delay in delivery under World War contracts was the incompleteness of the design of the matériel. Educational orders would enable the War Department in advance of an emergency to test and perfect designs, drawings and specifications in actual production in commercial plants, and to train a competent corps of ordhance inspectors, in addition to preparing the coöoperating manufacturers to do their part in supplying military equipment when needed by having on hand the special equipment necessary for interchangeability in modern industrial production.

IF the educational orders plan could be put into effect at this time, manufacturing plants capable of being turned into arms or munitions works could be required to have their plans revised, brought up to date, and completely worked out at Government expense. Each such plant could be required to install at least one complete unit of the machinery and equipment required to produce its allotted quota of war-time goods; and in each plant a nucleus of the skilled personnel required for making military equipment, varying in size according to circumstances, could be developed, trained and maintained as an active industrial reserve unit.

Educational orders also would be very important in keeping American industry interested in the manufacture of ordnance matériel, for actual production brings out problems that cannot be foreseen by academic discussion of specifications and contract terms, and reliable cost data can be compiled only from works experience.

Under normal peace conditions, only a very limited amount of work is carried on and relatively little money is expended for military equipment at our Government arsenals, and educational orders would in no way interfere with the present scheme of activities at these establishments. Our Government arsenals are basic training centers and laboratories, in the absence of which the educational orders plan could not properly function. Without experimental work at the arsenals, in addition to their constant normal functioning for the repair of equipment in everyday use, no progressive nor successful plan of ordnance development could be maintained. There would be no conflict, therefore, between the priming of industry by limited rearmament through educational orders and the normal operation of the six manufacturing arsenals which are operated directly by the War Department.

THE American Army today is using both obsolete and obsolescent types of armament, despite the fact that since the World War we have developed in this country markedly superior equipment of every kind and classification. Post-war types of arms have been developed in America to a high point of perfection, yet we find ourselves in the rather anomalous situation of possessing designs and types of new equipment while our Regular Army and National Guard continue to train with out-moded and antiquated weapons. This is particularly true with respect to antiaircraft guns and armored vehicles, including tanks, and in the case of artillery ammunition. In these, and other classifications, we have splendid designs and satisfactory models but little of the actual new equipment.

It is perhaps true that the greater part of the personnel of the Regular Army, to say nothing of the National Guard, have never even seen some of the new American standard types of arms and ammunition. This is a situation obviously which should be corrected, for the efficiency of our military forces depends on the possession and ability to use proper quantities of standard matériel.

While the educational orders plan is, therefore, of sufficient importance to justify liberal support in Congress and in military and business circles and to have popular backing on its own merit as an important feature of our American industrial preparedness scheme, and should be put into effect in any event, by launching it at this time, as an integral part of the Administration's economic recovery program, it would be a powerful industrial priming agency with a wide-spread and diversified application throughout the manufacturing sections of the nation.

It has been said of educational orders that their time-saving value in another war may be as the square or the cube of the time factor in the World War. That being so their meaning to the country today is beyond appraisal. They have all the national defense advantages claimed for them in the past. Now they offer a means to business recovery. They are worthy of general support and quick action.

The Gerlich Rifle and Bullet

A Discussion of the Methods of Obtaining High Velocity

By Glenn P. Wilhelm*

"How is it done?" is a question which has been asked by many readers of articles by Mr. Gerlich which have appeared in ARMY ORDNANCE. *No doubt this same question is in the minds of many other readers who have not actually asked it, especially with respect to the text and illustrations of the article "The Ballistic Efficiency of Guns—A Great Increase in Velocity has been Attained," published in the January-February, 1933, issue of this Journal.*

To provide the answer to this question the Editor requested Major Wilhelm to prepare the accompanying article. It is not necessary to state here, we are quite confident, that official tests of the Gerlich rifle and bullet conducted by the Ordnance Department are considered confidential, and that, consequently, Major Wilhelm does not disclose any information which has not already been published abroad.—Editor.

THE advantages of high muzzle velocities and high remaining velocities are realized by every one who has the slightest knowledge of military fire power, for high muzzle velocity means high muzzle energy with its consequent great stopping power. High remaining velocity at battle ranges insures that the bullet travels in a curve approximating a straight line, so that the danger space is continuous, one sight setting is all that is required, wind and weather have an inappreciable effect on the bullet, and the time of flight is reduced to negligible proportions, all of which are of particular benefit in the case of moving targets. The disadvantages of high velocities in the past have more than offset the advantages. The principal disadvantages are increased recoil and a decreased accuracy life of the barrel.

Until the general military use of smokeless powder in small arms, muzzle velocities did not greatly exceed the velocity of sound in air, which is about 1100 f.s. The use of black powder made it impossible to greatly increase such velocities in the state of the art of making bullets and barrels at that time without dangerously increasing the pressures. These pressures were very high at the breech, due to the quickness of black powder, and comparatively low at the muzzle. The old-time cannon shows this very clearly by the thickness of the metal at the breech as compared to that at the muzzle. Smokeless powder smoothed out the pressure curve, so that the push was not all at the breech, making it possible to maintain pressures at the muzzle. This is illustrated by modern artillery in which the comparative thickness of the breech and muzzle of the tube is insignificant as compared to the old-time cannon.

For small arms the muzzle velocity has become standardized to about 2700 f.s. for machine guns and shoulder weapons using calibers of approximately caliber .30. With a military bullet weighing from 150 to 180 grains this is about the highest practicable service velocity considering all the factors involved, such as barrel life, flash, smoke, etc. Slight changes in powders, primers and bullets enable this figure to be exceeded perhaps as much as 10 per cent, but if standard practice is followed a greater increase in velocity is not practicable. However, considerable study and investigation have been given to methods of increasing the muzzle velocity in ways which do not follow the present conventional practice. Some of the methods are essential to this discussion.

*Technical Staff, Office of the Chief of Ordnance. Major, Ordnance Department, U. S. Army.

THE CORK-AND-DARNING-NEEDLE IDEA. From the standpoint of interior ballistics it is desirable to have a bullet which has little mass but great cross-sectional area (consequently low sectional density) in order to give the powder gases a sufficient area upon which to push. In a rifle this would mean a bullet of about ½-inch in diameter made of cork which would be light enough to accelerate rapidly, would have little mass and would have little resistance to taking the rifling. As soon as the cork left the muzzle of the barrel it would be useless for flight through the air, because from the standpoint of exterior ballistics it is most desirable to have a bullet of the smallest cross-sectional area with the greatest sectional density. Such a bullet conceivably might be a darning needle made of some heavy material such as tungsten. Another way of stating it might be to say that the bullet should travel sideways in the bore and lengthwise or endwise outside the bore. Practically all the attempts that have been made to increase muzzle velocity beyond the increases possible by conventional means, utilize this idea of low sectional density of the bullet in the barrel (the cork idea) and high sectional density (the darning needle idea) for flight through the atmosphere.

THE OLD GERMAN NEEDLE GUN CARTRIDGE. Without going too far back into the past it will be sufficient to state that the first promising idea on this principle was developed from the use by the Germans of their old needle gun cartridge of the year 1855, in which they used an elongated bullet contained in a wooden base or sabot. Originally the bullet used in the needle gun was very little less in diameter than the wooden base and as the bullet left the muzzle the base dropped off. In the Franco-Prussian War of 1870 the French with their superior Chassepot outranged the Germans. This set the Germans experimenting and they made their bullet about the same length as before but with a decreased diameter. The caliber of the gun of course remained the same, and no change was made in the wooden base. Since the length of the bullet was altered very little, it still had high sectional density for flight through the air with a correspondingly decreased cross-sectional area. On the other hand, in the barrel of the gun it had low sectional density in so far as the effect of the gases on the wooden base was concerned. It is understood that the muzzle velocity was increased from 920 to 1100 foot seconds. It is also understood that the range of the gun was really doubled from 650 yards to 1300 yards.

This adaptation was not completed until after the Franco-Prussian War. As a matter of fact, in practice this manner of chasing the devil around the stump, so to speak, did not work out very well, and the use of modern types of cartridges with smokeless powder did away with its need.

THE PATENTS OF CARL PUFF. The next most important step for obtaining high velocity appeared to have been made by a German engineer, Carl Puff, of Spandau, who obtained several patents in Germany in 1903 and 1904 for the purpose of firing bullets or projectiles from rifled weapons having a markedly conical bore. Hereafter I will refer to the conical bore as a tapered bore, that is, a bore which decreases in caliber from the breech to the muzzle. The purpose of the tapered or conical bore was to enable the bullet on being fired to present a greater sectional area to the powder gases with their initial high pressure and yet to have a relatively smaller sectional density per unit. As the bullet advanced in the barrel the surface exposed to the pressure gradually diminished by the squeezing of the bullet which, in turn, gradually increased the sectional density. As the bullet left the muzzle it was better able to overcome air resistance as a consequence of its decreased diameter and increased sectional density.

Puff covered in his patents a variety of ways of carrying out the idea of the cork in the barrel and the darning needle in the air. His ideas included the old method of guiding from the base of the bullet with a sort of sabot and various forms of rings, bands and pads. (Fig. 1.)

The Puff idea was so promising that Lieutenant Colonel Heydenreich, instructor in the German Army, in 1908 considered that an Infantry rifle bullet could be designed on the Puff principle which would revolutionize warfare. He considered that it was advisable to make a lead-cored jacketed bullet with a long slender point which was just coming into general use about 1908, but having a cylindrical band attached to the rear. This band was designed in various forms. The finished bullet would somewhat resemble an artillery projectile from which a driving band had been extruded. Colonel Heydenreich proposed for this bullet and for other bullets which were to be guided by expanding rings or bands a barrel which would have deep rifling in the rear to correspond to the diameter of the guiding band, the barrel to be tapered towards the muzzle so that the depth of rifling would become shallow at the muzzle. In traversing the bore the guide ring was to be pressed back into the bullet gradually in proportion as the bullet passed down the barrel. Actually, bullets were made this way and when recovered showed that the band had been pressed down.

Apparently Puff received experimental orders both from the German government and the Russian government. With a bullet diameter of 7.78-mm. in its cylindrical part and the diameter of the extruded ring 9.21-mm. and using a charge of 3.8 grams of smokeless powder, a velocity of 2700 f.s. was obtained, with a maximum pressure of about 46,000 lbs. per sq. in. The weight of the bullet was 210 grains, which makes this a very commendable performance.

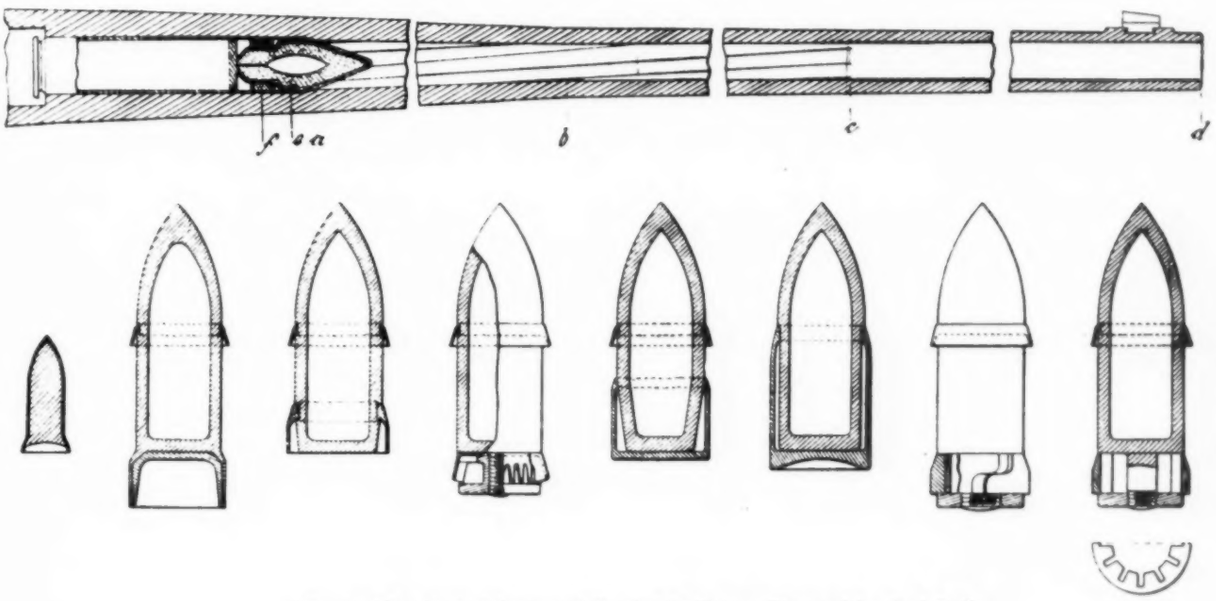

Fig. 1. The Conical Bore and Banded Bullets as Patented by Carl Puff.

Colonel Heydenreich considered that the advantages of the Puff bullet were that for a given caliber and weight of bullet a greater initial velocity could be obtained with a lower maximum pressure, or, conversely, by keeping the pressure constant, increased initial velocities could be obtained, particularly by using a lighter bullet. He was much impressed with the penetration against steel plates by bullets at high velocity, and he believed that the caliber should be reduced sufficiently to obtain much higher velocities. It is interesting to note that in at least some of the Puff barrels a gradually increasing twist of rifling was utilized. Colonel Heydenreich believed that within a short time all nations would be armed with a weapon utilizing the Puff principle and that it would be a self-loading gun. He believed that France would be the nation to do it first because at that time they had the least modern rifle, but he considered that whatever nation had available the smallest high velocity caliber with sufficient shock effect would be the one that would come out on top.

There have been other attempts to use a base guide with a decreased cross-sectional area of the bullet such as the one proposed by the German, Roth, but without doubt the most successful one up until recent times was Puff's.

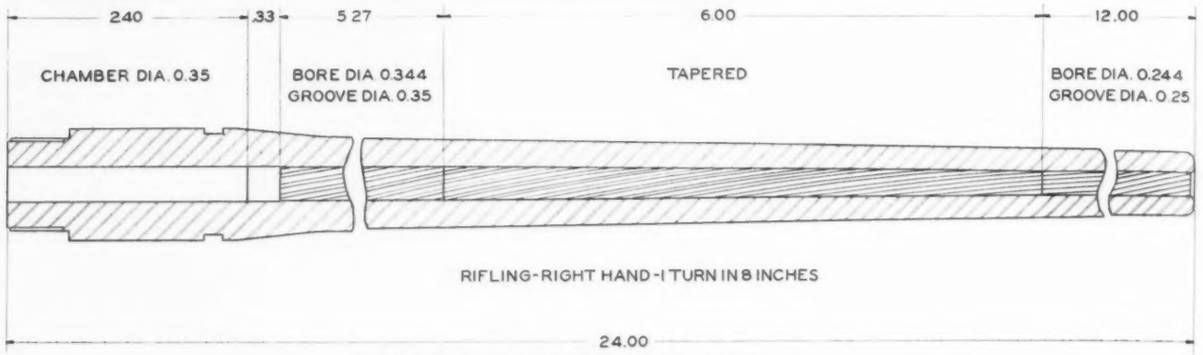

Fig. 2. Ultra-High Velocity Tapered Barrel.

The Gerlich Halger-Ultra. This brings us down to the Gerlich Halger-Ultra which at the present time appears to be the most successful development of the cork-and-darning-needle idea. Mr. Gerlich's method of getting high velocity is in principle essentially the same as Puff's. It might be stated that it is Puff's idea carried out to a much higher degree. There are certain fundamental differences, however, between the two methods which are important and which make the Gerlich principle more promising even than Puff's. Mr. Gerlich's barrel is of three different sections in so far as the bore of the barrel is concerned. These three sections consist of a wide cylindrical rear, an intermediate cone, and a narrow muzzle tube; that is, the rear portion of his barrel is a cylinder of comparatively large caliber, the central section of the barrel is tapered ending in a muzzle section which is cylindrical but is considerably smaller in caliber than the rear cylindrical section. The lands are much deeper at the breech than they are at the muzzle.

The Gerlich bullet is fitted with two flanges which might be described as wings. These wings fit the groove diameter and make a very good gas seal. The illustrations shown in Figs. 2 and 3 show designs of this type of bullet and barrel

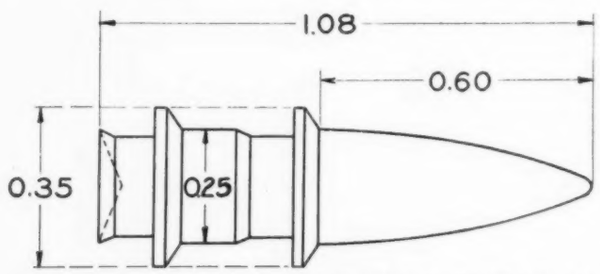

Fig. 3. Banded Two-diameter Bullet Caliber .25, Weight 100 Grains. Sectional Density on .25 Diameter, 1040; on .35 Diameter, 2037.

made by Mr. J. C. Gray, an Ordnance Engineer in the Office of the Chief of Ordnance. These drawings were made from a description of the bullet published abroad, and were made before either the Gerlich rifle or bullet had been seen in this country.

As the bullet proceeds along the barrel it reaches the tapered portion where the wings begin to fold into the recesses cut in the cylindrical body, so that when the bullet leaves the barrel it is a smooth cylinder with good ballistic qualities.

Since only the narrow flanges touch the walls of the barrel, forcing resistance in the Gerlich bullet is at a minimum, although the gas seal is at the maximum. The amount of friction is reduced, and by the use of the right kind of powder this type of bullet gives very high velocities. Gerlich's bullet, as usually proposed, is boat tailed, but there is no advantage in boat tailing a bullet at very high velocities since at velocities much beyond that of sound it is only the point of the bullet that encounters the air, leaving the balance of the bullet in a vacuum.

If Mr. Gerlich had proposed to the writer several years ago that a banded bullet would work in a barrel, the taper of which started at a point well forward of the chamber, and that the bands would fold into a recess as the bullet passed through the barrel so as to provide accurate flight through the air, the obvious answer would have been that there were several reasons why such a scheme would not work. These reasons are—

1st—The bands would not be able to stand the gas pressure;

2nd—If the bands were strong enough to stand the gas pressure, they would be too strong to fold down;

3rd—The bands would strip and fail to rotate the bullet;

4th—The interior of the bore of the barrel would be bulged when the bullet struck the resistance of the taper;

5th—The bullet would not fly true as the bands would not fold uniformly and the bullet would not be concentric.

However, since it has been demonstrated as a fact, it can be compared to Columbus' stunt of standing an egg on end, which is easily understood after seeing it done. The barrel does not bulge because the bullet slides so easily on the bands that there is no tendency to check when it strikes the taper; the bullet does rotate properly because it starts turning immediately with the driving edge of the lands applied on the outer rim of the bands which are of considerably greater diameter than the bullet proper, thus supplying additional leverage.

It is understood that Mr. Gerlich has been granted patents in most of the countries abroad, including Germany and Great Britain. In the United States he has patents pending. His patent claims are quite broad and include various calibers, combinations and modifications of tapered and cylindrical bores and banded bullets or banded and winged bullets.

THEORETICALLY there are several possible ways of getting high initial velocities. These include conventional methods and modifications of conventional methods together with combinations of conventional methods with the cork-and-needle idea. These methods may be enumerated as follows: first, using a larger charge of powder which of course increases the pressure; second, utilizing a powder which has a different pressure relation curve, for example, the change from black powder to smokeless powder; third, the use of a tapered bore with flanged bullets; fourth, using lighter bullets.

The present pressures in small arms such as the Springfield rifle and the Browning machine gun are about 50,000 lbs./sq. in. These weapons are proof tested to pressures about 70,000 lbs./sq. in. The highest pressures that would be considered practicable to use in special guns would not be over 60,000 lbs./sq. in., at the most. The first method therefore of increasing the pressure certainly would be limited to 60,000 lbs./sq. in. The second method of using a different character of charge, one which, for instance, would have more energy, could not from a theoretical and practical viewpoint, increase the energy more than about 20 per cent. The bullet energy can be increased materially by utilizing all the various factors enumerated above.

Using conventional means, increased pressures and lighter bullets would allow an increase in velocity of several hundred foot seconds. Aside from the danger, such increased pressures rapidly erode the barrel. Increased pressures with changed pressure relation curves using light bullets of the Gerlich type with tapered barrels promise a successful means of increasing muzzle velocity one or more thousand foot seconds without seriously decreasing the life of the barrel. The superiority of the Gerlich type over the conventional type of bullet and barrel is that the Gerlich type materially decreases forcing resistance initially and as the bullet passes through the barrel. Moreover, the Gerlich method gives the best means so far discovered of obtaining obturation (gas seal). The most significant feature of his barrel and bullet is his utilization of the peak of the pressure curve at the breech portion of his barrel by his method of keeping the rear portion of his barrel cylindrical instead of starting the taper immediately. This is a vital improvement on Puff's idea that perhaps makes possible the achievement of velocities as much higher than the Puff method as the Puff method is higher than the conventional bore.

Improvements in conventional armor-piercing bullets may make the Gerlich method (which, after all, lacks the simplicity of conventional methods) unnecessary for small caliber use against armored vehicles, although the Gerlich method would still be the only practicable way of materially reducing time of flight which is so important for antiaircraft firing. This feature alone would make it well worth while.

THE chief questions which arise, considering the apparent success of the Puff experiments and the present interest in the Gerlich method, are:

1st—Why was not the Puff principle adopted at the time?

2nd—Why is the interest at the present time so great, considering the disadvantages of high velocities?

The answers are quite obvious. At the time the Puff principle was being worked upon, the first tank had not made its appearance. Armor plate was not being used for the protection of anything except artillerymen. The airplane with the ultra high speeds had not appeared. For average Infantry service conditions the increased advantage of the Puff cartridges and barrels would not compensate for the disadvantages. Such bullets and barrels are difficult to make and the increased recoil offset the slight increases in velocity.

Now conditions are different. Antiaircraft fire and antitank fire require high striking velocities: antiaircraft, in order to reduce the time of flight; the antitank, in order to penetrate the armor. The Gerlich method promises increases in velocity of possibly 100 per cent rather than an increase in velocity of a mere 10 or 20 per cent. However, it is not all easy sailing. The cartridges for any of these principles, that is, the cork idea, are considerably larger and more bulky than the average Infantry cartridge, although they shoot a smaller bullet. Such cartridges and such barrels are, in the present state of the art of manufacture, expensive, and do not lend themselves readily to quantity production. The development is still in the experimental stage. Due to the decreased size and lack of space of the bullets or projectiles with the cork idea, it is more difficult to utilize such bullets and projectiles as tracer in the case of small arms and for explosive charges in the larger calibers. Changes are being made in armor plate design at the present time and some of these changes are such as to appear to be promising in so far as being effective against penetration of very small caliber bullets at very high velocities.

In summing up, it is considered that the development of weapons of extremely high velocity should be pushed, and it is believed that such a development is promising but there are many obstacles to be overcome, and it is too much to expect at the present time that anything very revolutionary will be accomplished in the near future. A valuable moral is contained in the prophecy previously referred to by Colonel Heydenreich, who expected that shortly after the year 1908 ultra high velocity weapons would have replaced the conventional type. We are now in the year 1933, a quarter of a century later, and conventional weapons are still being used and will likely continue in use for some time because of their simplicity and reliability.

EDITOR'S NOTE: In the article entitled "The Ballistic Efficiency of Guns" by H. Gerlich, published in the January-February 1933 issue of ARMY ORDNANCE, the following statement appears on page 216 (left hand column): "Aside from the fact that my pressure-ratios are much higher than 0.5, the general's figures are obviously wrong by a whole decimal; *i. e.*, they are ten times too high. In view of the resulting muzzle energy of 2980 m/kg. and in connection with the bullet's travel within the 7-mm. bore of 0.7 meter length, and under the premises of the general's calculations, this maximum pressure would be $\frac{2980}{0.7 \times 0.385} = 11{,}070$ kg/qcm. I point out this mistake without touching others and venture the opinion that such a regrettable slip should most certainly not have been made." The reference to *maximum* pressure is obviously an error and the term *mean* should have been used instead. Maximum pressure would be in connection with the maximum pressure ratio of 0.5 twice as high, *i. e.*, $\frac{11070}{0.5} = 22140$ kg/qcm.

Mr. Gerlich also calls attention to a typographical error on page 217 of the same article where he discusses the ballistics of his rifle. As published the statement was made that the results have been achieved without difficulty as regards "length of barrel and weights of the respective arm which may be even shorter or *longer* than those of our present standard." The term *longer* is obviously incorrect and misleading. The statement should have read, "In further reply to General Rohne I am in a position to state emphatically that the ballistics which I have realized with my Ultra arms are obtained without difficulty as regards length of barrel and weights of the respective arm which may be even shorter or *lighter* than those of our present standard which are admittedly suitable for actual warfare."

ARMY ORDNANCE regrets that these errors of terminology were published in Mr. Gerlich's important paper. They were unintentional, of course, and correction is gladly made.—ED.

BRIGADIER GENERAL COLDEN L'H. RUGGLES

FORMER ASSISTANT CHIEF OF ORDNANCE, U. S. ARMY
ARMY ORDNANCE ASSOCIATION MEDALIST, 1932
DIED APRIL 2, 1933

"For unusual accomplishment and outstanding service in the advancement of industrial preparedness the Medal of Merit of the Army Ordnance Association is awarded to Brig. Gen. C. L'H. Ruggles, U. S. Army, retired, of Charleston, S. C. A graduate of the United States Military Academy, class of 1890, General Ruggles served through grades and was promoted to the rank of Colonel in 1917. After a tour of duty as Professor of Ordnance and Science of Gunnery at the Military Academy, General Ruggles was in command of several ordnance establishments including the old Sandy Hook Proving Ground and the Aberdeen Proving Ground which he established. During the World War he served as head of the Inspection Division of the Ordnance Department and later with the A. E. F. As Chief of Manufacture General Ruggles rendered exceptional service in promoting our industrial mobilization plans. To him as much as to any other one man are due the success and coöperation on the part of industry which have attended this important phase of the national defense in recent years."—*From the address by Col. C. L. Harrison, Chairman of the Association's Committee on Awards, 1932, at the Fourteenth Annual Meeting last December when the Medal of Merit was Awarded to General Ruggles.*

Automatic Firearms

Mechanical Principles Used in the Various Types, Part I

By J. S. Hatcher*

AN automatic firearm is one which fires, throws out the empty cartridge and reloads itself when the trigger is pulled. Strictly *automatic* firearms will also keep on firing as long as the trigger is held down; but the term automatic pistol, or automatic shotgun, etc., is often used to designate what is more properly called a *semiautomatic* or *self-loading* gun, which is one that unloads and reloads itself but which fires only one shot for each pull of the trigger. Thus on the Government automatic pistols the trigger must be released and pulled again for each shot fired.

The first automatic firearm was the Maxim machine gun. Machine guns were known for many years before the advent of the Maxim gun in 1884 but these older machine guns were hand-operated. In other words, they were worked with a crank like a sausage grinder, the cartridges being fed into a hopper, or feed way, by one hand while the other one turned the crank. In 1880 Sir Hiram Maxim was traveling in Europe demonstrating some inventions in electricity when an acquaintance in discussing the business aspects of his inventions, is said to have remarked to him: "Hang your electricity and magnetism; if you want to make some money invent something to help these Europeans cut each other's throats and you will be a rich man."

Maxim, much impressed by the war-like operations he saw around him, thought that this was good advice so he started in to make an automatic machine gun. In casting about for the motive power to operate his gun, he thought at once of the terrific kick he had received as a boy when firing one of the Army rifles and he decided that the kick, which up to that time he had regarded as merely an unpleasant annoyance, might very easily be harnessed and made to do very useful work. The result was that he constructed a mechanism in which the barrel of the gun was allowed to kick back for about three-quarters of an inch when the shot was fired, and this backward motion was utilized to unlock the breech, eject the empty cartridge and feed a new one in. Maxim's gun was, therefore, what is known as a *recoil-operated* gun.

IT was not very long after this that John M. Browning, a gunsmith of Ogden, Utah, conceived the idea of making an automatic gun that would operate like a little gas engine. He bored a hole in the barrel of the gun about a foot from the muzzle and fitted this hole with a piston on the end of a swinging lever. When the gun was fired, the bullet first passed this little hole in the barrel, then the gas under very high pressure struck on the piston resting in this hole and drove it downward with great force. This piston was on the end of a lever which was swung downward and to the rear by the force of the gas, operating a connecting rod which worked the breech mechanism. This gun was said to be *gas-operated*. The invention of the Colt gun by Browning in 1889, was almost immediately followed by the invention by Baron Von Odkolek, in Austria, of a gun in which the gas acted on a piston moving straight to the rear in a tube under the barrel. This gun, also gas-operated, was subsequently developed into the Hotchkiss.

As soon as the first successful machine gun was produced, this very fact turned the attention of inventors to the subject of automatic firearms and almost immediately there were a large number of inventions produced along this line. Many of the early efforts turned to pistols and some successful ones such as the Mauser, Luger, and Colt, were soon produced. All these guns worked on the recoil-operated principle.

During the forty years that have elapsed since the automatic machine guns first demonstrated their success, there have been hundreds of attempts to make machine guns, semiautomatic rifles and automatic pistols, and the patent offices and war departments of the world have been inundated by a constant flood of inventions of this general category. It is really amazing to see the different ingenious devices that were thought of in an effort to produce a successful semiautomatic shoulder rifle. Most models of such guns were either recoil-operated or gas-operated, but there have been dozens of models based on novel principles, such as operation by the movement of the primer in the cartridge case; inertia-operated shoulder guns in which a sliding weight remains relatively stationary while the gun recoils; guns with movable butt plate resting on the shoulder of the firer and operating through a system of rods to unlock the gun when the kick pushed the butt plate against the firer's shoulder; guns in which the breech was held stationary and the barrel allowed to move forward; and many others, the principal ones of which will be described in detail later.

MUCH of the mechanism of the machine gun is involved in the locking and unlocking of the breech block. A high-powered rifle cartridge generates a pressure of 50,000 pounds to the square inch when the gun is fired, and this pressure, acting on the head of the cartridge case, tends to force the breech block to the rear. Accordingly, when high pressure cartridges are used, the breech block must be securely locked to the rear end of the barrel in order to hold the cartridge in the chamber of the gun during the explosion. However, the force of the explosion of a cartridge is gone in a very small fraction of a second. The high pressure of 50,000 pounds to the square inch lasts less than one-thousandth of a second and then drops rapidly off to zero.

If we had a fairly heavy breech block, it would not move enough to do any harm during the very short time the pressure lasts. If the weight of the breech block could be chosen correctly, it would be possible to make a breech mechanism in which no locking device would be necessary. The pressure on the cartridge case would be just sufficient to give the heavy breech block enough movement so that the breech would open after the cartridge is fired, and if the proper spring were put behind the breech block it would close again, pushing a new cartridge in at the same time.

*Chief, Small Arms Division, Office of the Chief of Ordnance, Washington, D. C. Major, Ordnance Department, U. S. Army. Republication of this article in whole or in part without permission is reserved. Copyright, 1933, by J. S. Hatcher.

Blow-back Guns: Actually such a breech mechanism, called the *straight blow-back* system, is perfectly practical for low-powered cartridges, and such mechanisms are used on almost all pocket automatic pistols and on caliber .22 automatic rifles. The breech block is simply held against the head of the cartridge by a spring, and when the gun is fired, the powder pressure blows the bullet out through the muzzle with very great rapidity, and at the same time pushes the breech block back with just the right speed to extract the fired case after the powder pressure has fallen to zero. If the breech block is made too light, it will open too quickly, and if it opens while pressure is still in the cartridge case, the cartridge case will be ruptured and gas will escape to the rear.

Calculations and experiments have shown that for the caliber .30 cartridge, such as is used in the Springfield rifle, the breech block would have to weigh in the neighborhood of twenty-seven pounds to operate satisfactorily on the blow-back principle. As the Springfield rifle itself weighs only nine pounds, the use of this kind of breech mechanism is obviously impracticable for a semiautomatic shoulder rifle using the Springfield cartridge, where the weight must be kept down to the lowest possible figure. Moreover, such a breech block is entirely too heavy for even a machine gun using the full powered Army rifle cartridge.

However, straight blow-back guns powerful enough for hunting have been produced but these guns are considerably less powerful than the Army rifle. The most powerful hunting rifle built on the blow-back principle is the Winchester self-loading rifle which is made in .351 and .401 calibers, with a straight cartridge shaped somewhat like a large pistol cartridge.

Even though the mechanisms of the blow-back type do not seem to be suited for military machine guns or semiautomatic rifles, the straight blow-back principle was applied to the Springfield rifle in the production of the Pedersen device which was described in the May-June, 1932, issue of Army Ordnance (Vol. XII, No. 72). This remarkable weapon was an automatic bolt for the Springfield rifle, enabling the rifle to be converted in a few seconds into a semiautomatic gun capable of firing forty shots with one reloading and having detachable magazines so that after the forty shots were fired new magazines containing forty more cartridges could be attached almost instantly.

The application of the blow-back principle to the military rifle in this case was made possible by the fact that instead of using the full powered military cartridge, the device used a caliber .30 pistol cartridge of very much the same size and dimensions as the cartridge for the caliber .32 automatic pocket pistol but considerably more powerful. The device was in reality nothing more or less than an automatic pistol specially shaped so that it could be attached in the breech of the rifle in place of the regular bolt. The additional power of the cartridge was taken care of by a weight attached to the breech block of the device.

Diagram of a Typical Blow-back Mechanism: Fig. 1 is a diagram showing the principle of the Winchester self-loading rifle, the most powerful blow-back gun. In order to handle the powerful cartridge used in this rifle, the breech block must have a considerable amount of weight, which is provided by attaching to it a large bar of iron which lies inside of the hollow wooden forearm under the barrel. The weight of this large piece of metal lying inside the forearm of the gun, gives a rather curious balance to these self-loading rifles, but aside from this they are very satisfactory guns.

Referring to Fig. 1, *B* is the breech block proper, but *B, C* and *D* are all one piece of metal, as the sliding weight, *D,* lying inside the hollow wooden forearm of the gun is connected to the breech block, *B,* by the slotted section, *C,* which straddles the magazine well and the hammer. When the gun is fired the breech block slides to the rear, ejecting the empty cartridge case and at the same time compressing the return spring *E*. This return spring then forces the breech block forward again, feeding in a new cartridge from the magazine. The rearward motion of the breech block also serves to force the hammer down into the cocked position. The straight blow-back guns are the simplest of all automatic firearms as regards mechanism.

"Blow-Forward" Mechanisms: We have seen above that some method must be provided to hold the breech block against the barrel when the gun is fired, because otherwise the pressure of the powder gas pushing back on the cartridge case would drive the breech block back away from the barrel and let the cartridge out while the explosion was going on. With the blow-back gun the breech block is allowed to move in this manner, but is made heavy enough so that the movement does not occur too quickly.

Instead of allowing the breech block to move back, it would be quite possible to attach the stock and all the framework of the gun firmly to the breech block and then allow the barrel to move forward when the gun is fired instead of allowing the breech block to move back. Several automatic pistols, notably the Schwarzlose, have been constructed on this principle.

In 1917 an inventor appeared at Springfield Armory with a machine gun made to fire the Krag army cartridge, having the framework of the gun solidly fixed and the barrel loosely mounted so that it could move forward against the action of a spring when the gun was fired. This gun operated, but it was necessary to grease the cartridge case to prevent the front part of the case, expanded by the pressure, from sticking to the barrel as it moved forward.

One trouble with this system is that it greatly accentuates the recoil. The normal tendency of the explosion in the cartridge case is to push the bullet in one direction and the cartridge and breech block in the other. When there is no provision for locking the breech block to the barrel but instead it is attached to the framework and stock of the gun, and the barrel left loose, it is obvious that the explosion drives not only the breech block but the stock to which it is attached back against the shooter's shoulder with a considerable amount of violence.

This inventor had besides his machine gun, a semiautomatic shoulder rifle built on this principle, though the mechanism was only crudely worked out. He demonstrated this gun by firing a number of shots with it and then allowed the Armory officials to fire it. I fired one or two shots with it and the kick was so terrific that I felt as though a mule had landed one of his hind feet on my shoulder. I seemed to be kicked back two or three feet from where I was standing and the tears actually ran out of my eyes from the blow, which made us marvel as to how the inventor, who was a frail, pathetic looking man, managed to shoot it without any signs of discomfort. After showing his model he returned to a nearby factory to complete the mechanism but a few days later we were dis-

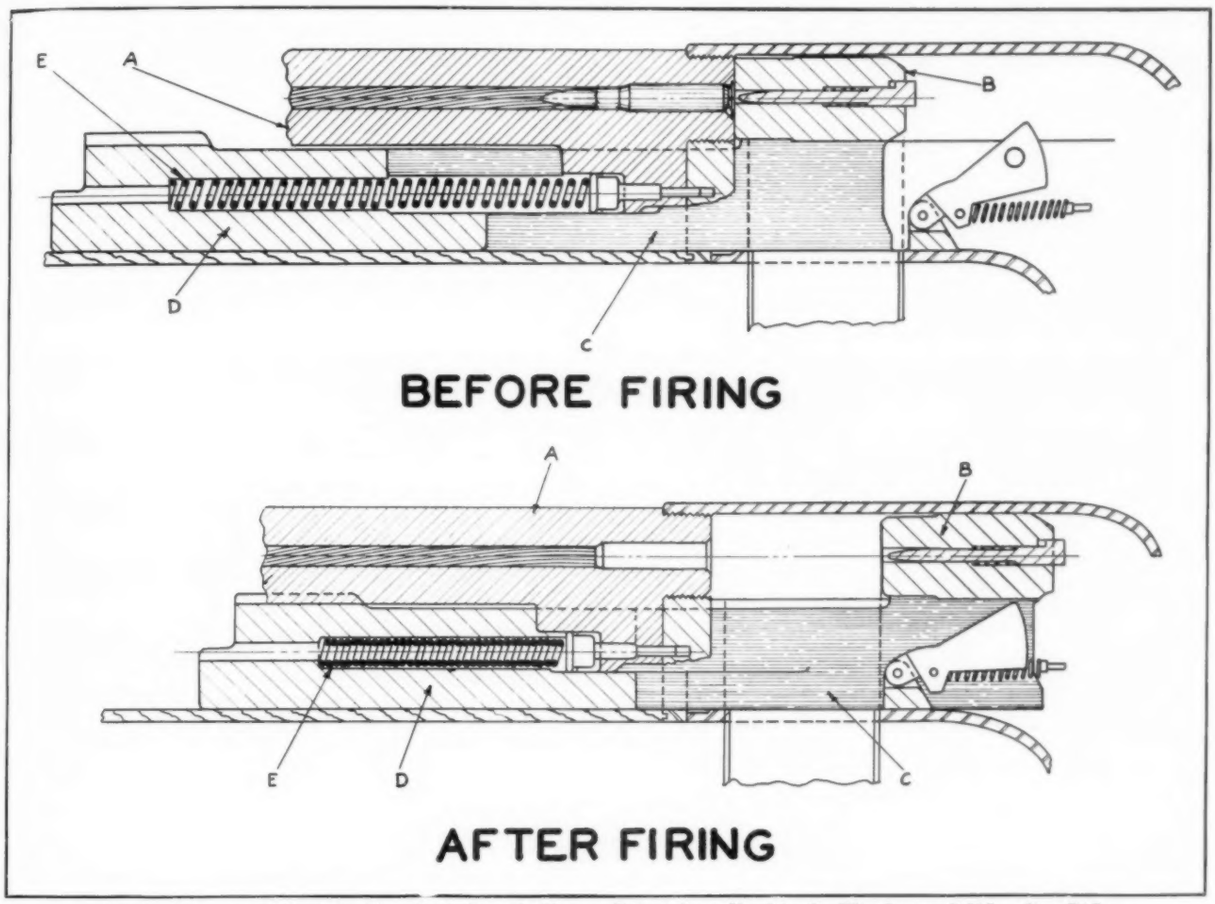

Fig. 1. Diagram of Straight Blow-Back Breech Closure Principle as Used in the Winchester Self-Loading Rifle.
(For explanation see text, page 270.)

tressed to learn that he had taken his new gun and deliberately blown his head off with it. Probably the kick was too much for him after all.

RETARDED BLOW-BACK MECHANISM: We have mentioned above that with light cartridges giving low pressures it is quite possible to use what is known as the straight blow-back breech mechanism, which depends entirely on the weight of the breech block to keep it from opening too quickly. We also stated that with the full power army cartridge the breech block would have to weigh about twenty-seven pounds to prevent it from opening too soon if we depended on weight alone.

There are other things that we can depend on besides weight to retard a blow-back action. In a straight blow-back the cartridge merely pushes the breech block directly to the rear so that the full thrust is exerted in the direction of the motion. Instead of using extra weight to slow up the action, we can slow it up by arranging so that the thrust is working at a mechanical disadvantage; in other words, so that it takes more push to produce the same amount of motion or the same push to produce less motion.

Then again, if we arrange the breech block like the piston of a gas engine so that it is attached to a crank and connecting rod, it is quite obvious that if the crank and connecting rod are exactly on dead center the breech block will be prevented from moving, and all the force will be transmitted to the crank shaft. If the gun were made like this it would never operate at all. However, if it is made so that the crank instead of being on dead center is just slightly to one side or the other of it, then most of the thrust of the breech block will be transmitted to the crank shaft, or in this case, the pin supporting the connecting rod, but there will be a certain component of it that will tend to drive the crank pin around in a circle just as the explosion does in the cylinder of an automobile. If the crank is almost exactly on dead center when the explosion starts, so little of the force in the breech block is directly applicable at once to moving the crank away from dead center that the motion is retarded sufficiently to enable the explosion to be largely completed before the breech block moves very far. The further away the crank goes from dead center, however, the more power the breech block has to accelerate the motion.

One of the principal machine guns of the world, the Schwarzlose, is made on this principle of the retarded blow-back, with the crank and connecting rod attached to the breech block as described above. In addition, the breech block is made fairly heavy and there is a very strong spring behind it. All these elements combine together to retard the motion enough so that full powered military cartridges can be handled successfully, though the breech is not actually locked to the barrel.

There is one queer thing, however, that is common to almost all blow-back and retarded blow-back guns, and that is that there is a tendency to rupture the cartridges unless they are lubricated. This is because the moment the explosion occurs

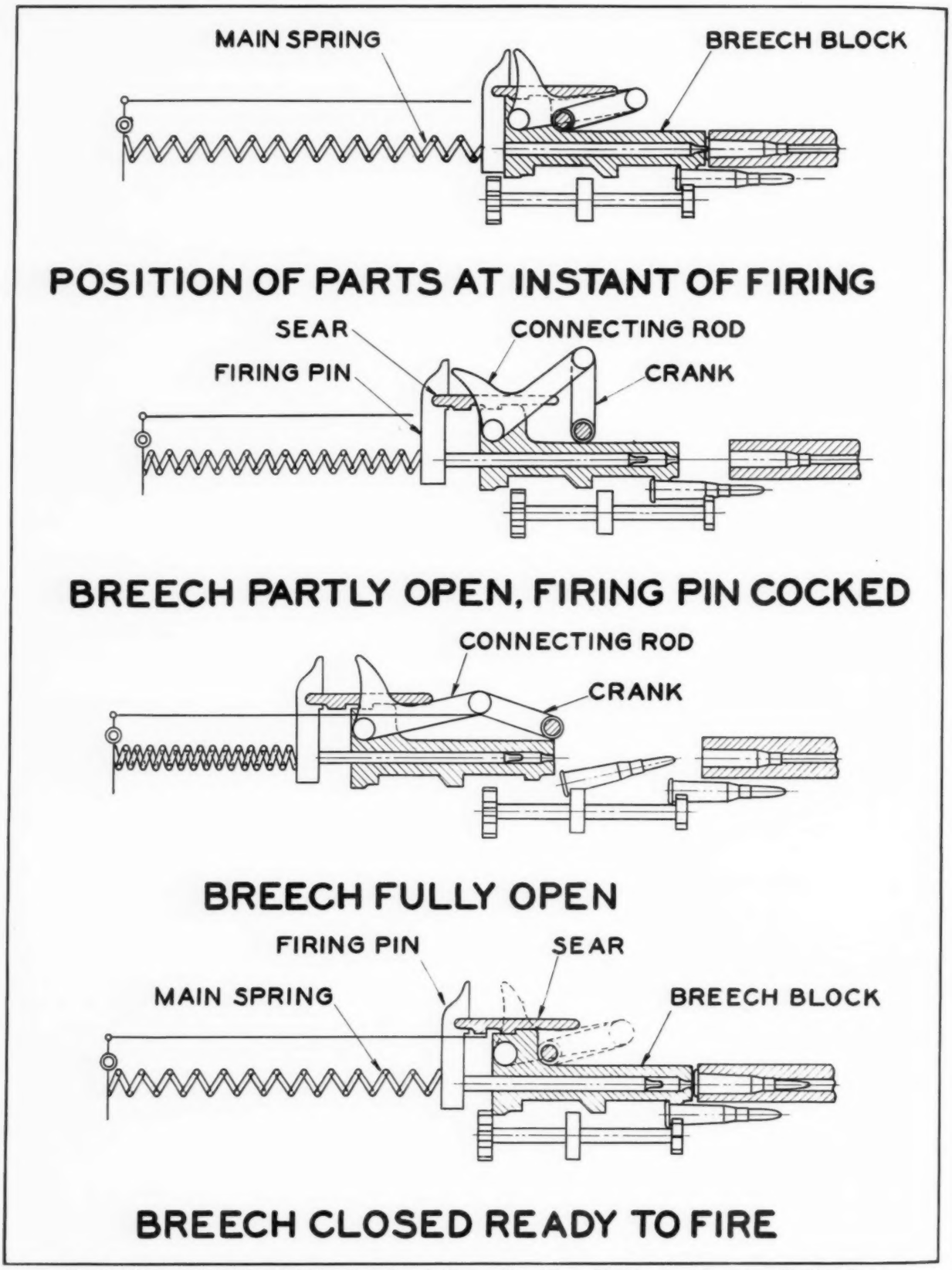

Fig. 2. Diagram of the Retarded Blow-Back Breech Closure Principle as Used in the Schwarzlose Machine Gun.

the thin front end of the cartridge case swells up from the internal pressure and tightly grips the walls of the chamber. Cartridge cases are made with a strong solid brass head and a thick wall near the rear end, but the wall tapers in thickness until the front end is quite thin so that it will expand under pressure of the explosion and seal the chamber against the escape of gas to the rear. When the gun is fired the thin front section expands as intended and tightly grips the walls of the chamber, while the thick rear portion does not expand enough to produce serious friction. The same pressure that operates to expand the walls of the case laterally, also pushes back with the force of fifty thousand pounds to the square inch on the head of the cartridge, and the whole cartridge being made of elastic brass stretches to the rear and, in effect, gives the breech block a sharp blow which starts it backward. The front end of the cartridge being tightly held by the friction against the walls of the chamber, and the rear end being free to move back in this manner under the internal pressure, either one of two things will happen. In the first case, the breech block and the head of the cartridge may continue to move back, tearing the cartridge in two and leaving the front end tightly stuck in the chamber; or, if the breech block is sufficiently retarded so that it does not allow a very violent backward motion, the result may simply be that the breech block moves back a short distance and the jerk of the extractor on the cartridge case stops it, and the gun will not operate.

However, this difficulty can be overcome entirely by lubricating the cartridges in some way. In the Schwarzlose machine gun there is a little pump installed in the mechanism which squirts a single drop of oil into the chamber each time the breech block goes back. In the Thompson Auto-Rifle there are oil-soaked pads in the magazine which contains the cartridges. In the Pedersen semiautomatic rifle the lubrication is taken care of by coating the cartridges with a light film of wax.

The diagram of the Schwarzlose machine gun (Fig. 2) shows how the crank and connecting rod work, as described above.

PEDERSEN SEMIAUTOMATIC RIFLE: Recently Mr. J. D. Pedersen has perfected a semiautomatic rifle on the retarded blow-back principle, and this rifle has given an especially satisfactory account of itself in trials. It also has a crank and connecting rod as does the Schwarzlose gun, but the mechanical arrangement is somewhat different. The operation of the Pedersen rifle is shown in Fig. 3. *A* is the breech block and is held against the head of the cartridge by the blocks *B* and *G* which are in line with each other and which transmit the thrust of the breech block to the heavy pin, *D*, which goes through the receiver. These three parts, *A*, *B* and *G*, form a toggle joint, and *C*, the point of contact between *B* and *G*, is just slightly above the line of thrust between the head of the cartridge case and the pin, *D*. Thus when there is a very heavy pressure on the front end of the

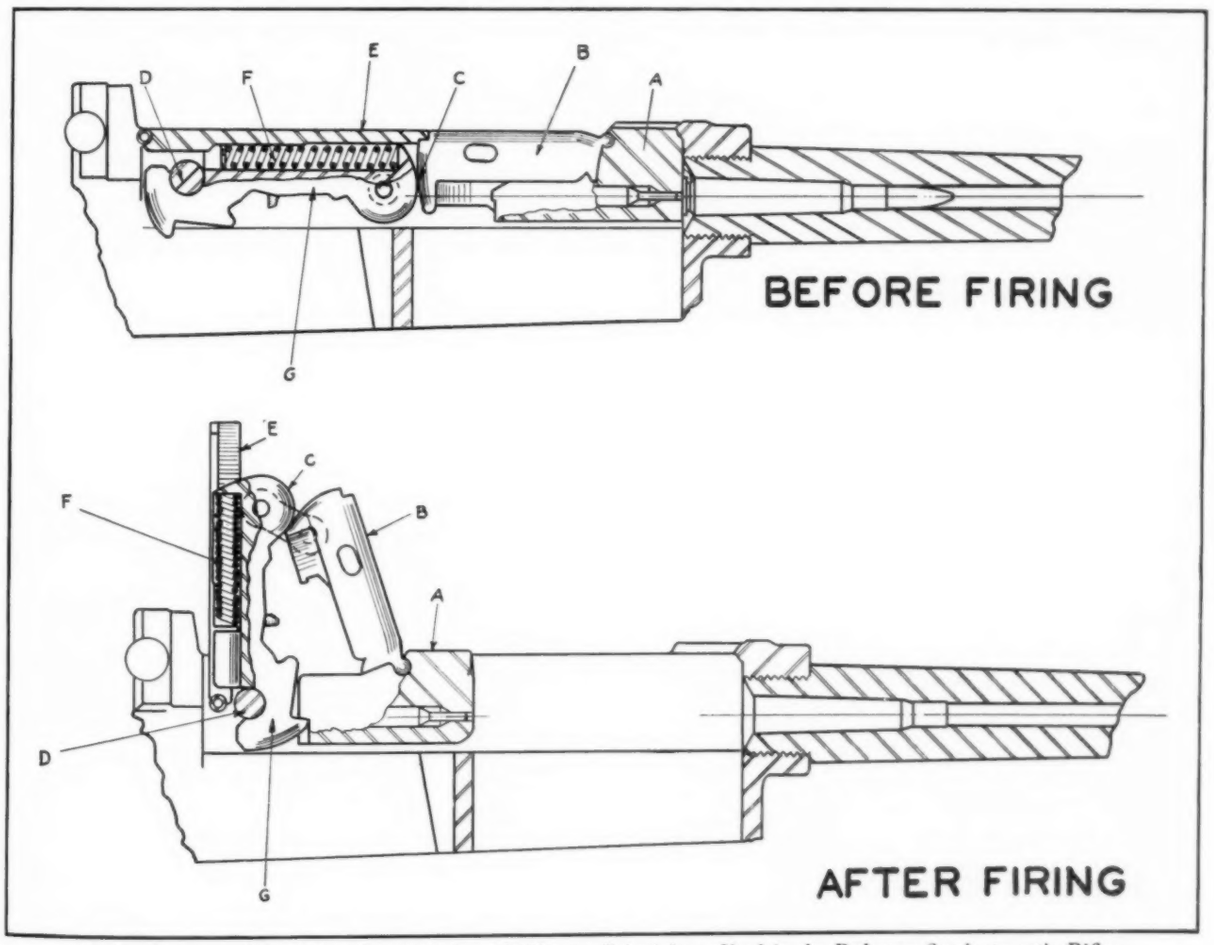

Fig. 3. Diagram of Retarded Blow-Back Breech Closure Principle as Used in the Pederson Semiautomatic Rifle.
(For explanation see text above.)

breech block, *A*, there is a tendency for the toggle joint to "break" and the piece, *B—G*, to move upward as shown in the cut marked "After Firing." If the point of contact at *C* were directly on the line of thrust, the toggle joint would remain locked and the breech would not open, but as this point, *C*, is just above the line of thrust the breech does fly open as soon as the pressure comes on the head of the bolt, but this opening is retarded because the two pieces, *B—G*, roll on each other in starting to open in such a manner that the contact point, *C*, continues for some little time to remain near the line of thrust. The shape of the rolling surface is worked out very skillfully in order to insure this result. As the breech opens the spring, *F*, is compressed and as soon as the motion is completed this spring causes the breech to close again.

The Pedersen rifle uses an "enbloc" clip of ten cartridges which are so arranged that the whole packet, including the clip, is forced into the magazine in loading the gun. After ten shots have been fired the clip flies out and the gun stays open ready for a fresh packet of ten to be dropped in. This rifle has been one of the strongest contenders for adoption by the Army, being second only to the new Garand gas-operated rifle in probability of adoption for Army use.

BLISH PRINCIPLE: Some experiments by Commander Blish, U. S. Navy, retired, led him to believe that inclined surfaces which would slide on each other under light pressure would not slide when the pressure was heavier. He is said to have been started on this investigation through observing that when heavy naval guns were fired with full charges the breech remained locked, whereas when they were fired with light charges the breech had a tendency to unscrew by itself. Accordingly he took out U. S. Patent No. 1,131,319, dated March 9, 1915, covering the application of this principle to firearms and describing his findings in detail with elaborate diagrams.

Utilizing this theory, the Thompson Auto-Rifle is constructed so that the breech block is locked to the barrel by a steep thread. The pitch of this thread is made just steep enough so that the gun will not unlock too quickly under the full pressure of the explosion. The supposition is that while the full pressure is on the breech block, adhesion of the threads on the breech block to the threads in the receiver will prevent any motion, but as soon as the pressure drops slightly this adhesion will no longer operate and the threads will then unscrew, allowing the breech block to open.

A diagram of this breech closure is shown in Fig. 4. The breech block, *B*, has steep threads, *D*, engaging the receiver, *C*. When the gun is fired the breech block unscrews from the pressure and opens against the action of the return spring which immediately shuts the breech block again and causes it to rotate into the locked position when the threads engage each other. The locking of the breech block is assisted by the action of a knob on the end of the bolt handle which adds a sort of flywheel effect to the motion of the bolt and thus assist in locking it securely.

There is no doubt that this mechanism can be made to operate as described, provided the cartridges are lubricated, but there has been some dispute among engineers as to whether or not the Blish principle really exists. Some of them claim that this is merely a retarded blow-back breech mechanism and that as soon as the pressure comes on the end of the bolt it starts to unscrew; but on account of the fact that the angle of the thread is so slow it takes a great deal of pressure to unscrew it, and for this reason the bullet is gone before the bolt has unscrewed enough to do any damage. That this type of mechanism actually opens while there is still considerable pressure in the cartridge case is evident from the fact that the gun does not operate satisfactorily unless the cartridges are lubricated.

THOMPSON SUB-MACHINE GUN: The Thompson sub-machine gun, utilized to fire pistol cartridges at a rapid rate from a magazine holding twenty-five or fifty, is also constructed on the Blish theory, but instead of having a screwed breech block with a steep thread as does the Thompson Auto-Rifle, it simply has the breech resting against a vertical sliding wedge held in its upper position by spring pressure. When the breech block is pushed backward a sloping surface on the rear end of the breech block resting on a similar surface of the wedge, cams the wedge downward as the breech block moves to the rear. This downward motion of the sliding wedge is supposed to retard the breech block in its rearward motion and thus assists in reliable functioning. Owing to the low pressure involved in the pistol cartridge, it is not necessary to lubricate the case. (*This article will be concluded in the next issue of this Journal where the long and and short recoil-operated types, the gas-operated and the primer-actuated types of automatic arms, with examples of each, will be discussed, with illustrations. The author will also describe the principle of operation of the Garand semi-automatic rifle and the caliber .22 machine gun, the remarkable invention of David M. Williams of Godwin, S. C.*)

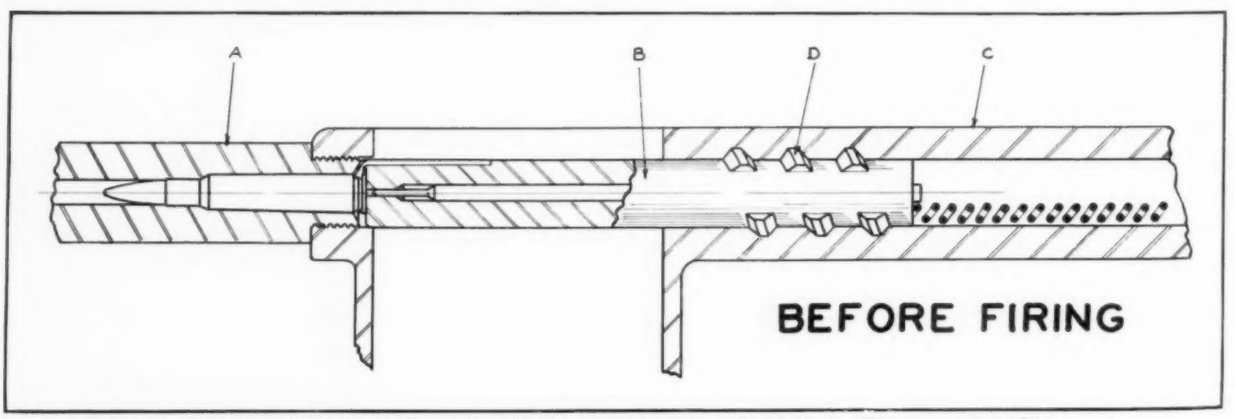

Fig. 4. Diagram of the Blish Type Breech Closure Principle as Used in the Thompson Auto-Rifle.
(For explanation see text above.)

The Ancient Cycle of War

The Failure of the Greeks and Romans to Limit Conflict

By Hoffman Nickerson*

THE idea of the business cycle is today all too familiar. Without discussing here how far the savage to-and-fro of our time between economic booms and slumps might be moderated, all the works of man follow a certain rhythm. Applying this to the relation between war and society, history shows that wars have always run in cycles between a strictly limited form and one which may be conveniently called unlimited, rising toward the war of complete extermination but happily never reaching that unattainable absolute, then falling back toward an equally unattainable minimum of mere police work.

The first known cycle of war, that of the Greco-Roman world, begins with the failure of the Greeks to limit war strictly and continues with the similar failure of the Roman republic. The Roman empire however succeeded in limiting it more strictly than any society before or since.

Confining ourselves to the Mediterranean and European origins of our own civilization, we find all ancient war politically limited by slavery. All ancient societies owned slaves. Often the majority of men were compelled by law to work for masters, and for a slave to be a soldier was exceptional. Sometimes a besieged city in its last extremity would arm slaves, and these would fight for their masters against the enemy. But normally slaves were considered unworthy of arms.

HISTORY in the full sense of continuous written record begins with the Greeks. Monuments and inscriptions have taught us much concerning the civilizations of Mesopotamia and the Mediterranean area; in Egypt and Mesopotamia we find large regularly organized, monarchical states, civilized and industrious populations and considerable cities several miles in circumference, the Mesopotamian cities highly fortified with double or triple walls studded with towers. We find also highly organized armies. At first these are of infantry alone; among the earliest Mesopotamian reliefs is one of warriors in close formation with spears, helmets and large shields, in Egypt considerable bodies of spearmen and bowmen are shown marching in regular formation and in step. Later the domestication of the horse modified warfare; at first horses were used for drawing chariots rather than for riding; about 1700 B. C. they seem to have contributed largely to the conquest of Egypt by an Asiatic tribe. Later still the Assyrians had not only chariots but also cavalry, siege machinery including battering rams, movable towers and crude catapults. The early Orient had the idea of empire by means of military conquest. The Assyrians inflicted the greatest cruelties upon the vanquished; in their case at least war seems to have approached its unlimited form. On the other hand we know little of the recruitment and composition of the early Oriental armies and still less of the social aspect of their wars. There may have been a tacit convention that only conquered kings and very high nobles were to be tortured and killed; it may have been the custom to spare the masses and at most to deport them to new homes.

The dawn of history finds the coasts of the Mediterranean covered with city states fully possessed of the arts, letters, laws and developed military institutions proper to a high civilization. East and southeast of the inland sea were civilized Oriental states much larger than a single city. Among the city states, those of the Syrian coast and of North Africa were of Oriental blood and civilization. The Oriental peoples followed religions either bestial or else deeply concerned with the mystery of evil, sometimes horribly so. Most of the city states, however, were European in race and culture and among the cities of European men the great majority were Greek.

In the beginning we find the highly gifted Greek people full of energy: increasing in numbers, expanding on the material side extensively by means of colonies, intensively through trade and manufacture. Their wars were partly fruitful in that they were almost always better fighters than the Orientals; their repulse of the Persians inspired the first triumphs of their civilization, and Alexander's conquest of the East led to a second successful phase. Nevertheless their first great period was dragged down by a century of ruinous civil wars within the Greek culture, beginning with the first and worst, the Peloponnesian war; and Alexander's conquests were followed by further dissension. To the end the intense patriotism of a Greek was for his own city; his sanctities were more local than universally Greek, still less universally human.

The typical Greek army was a universal-service militia into which all free citizens might be drafted, financial reasons usually prevented all being called out at once unless the city itself were beseiged. Since most manual work was done by slaves and much commerce was in the hands of non-naturalized resident aliens, the city militias were fairly well practiced in arms; also the Greek cult of athletics favored physical fitness. The typical armed man, the "hoplite," was the armored foot-soldier, fighting chiefly with a thrusting spear and equipped with metal helmet, cuirass, shin-guards and shield. The combination of a highly energetic and gifted people with a barren country—all islands and peninsulas, with small, moderately fertile plains shut in by mountains of bare rock—helped to produce food wars largely decided by sea power. Indeed navies were more highly developed than armies in that a specialized type of warship, useless for peace purposes, was developed; a long and narrow row-galley fitted with a ram and incapable of carrying cargo. Since siege machinery was at first unknown whereas stone fortification was well advanced, sieges were long and difficult and the usual object of a campaign was to destroy the enemy's standing crops, armies therefore took the field in summer not in winter. The short campaigns, in turn, suited the city militia system.

*Author: "The Inquisition, A Political and Military Study of Its Establishment," 1923; "Warfare" (with Spalding and Wright), 1925; "The Turning Point of the Revolution," 1928; "The American Rich," 1930. First Lieut., New York National Guard, 1916; Captain Ordnance Department, U. S. Army, 1917; Duty with General Staff, A. E. F., 1918; Member U. S. Section, Inter-Allied Armistice Commission, Spa, Belgium, 1918-1919. This article is a chapter from the author's forthcoming book, "The United States and the Next War"—a study of the relation between social forms and technical military forms, the effect of new weapons on war, the connection between democracy and the wars of the last 150 years, and the prospect of a new strict limitation of war. Another chapter will appear in the next issue.

The first Greek wars of the historic period were scuffles between individual city states. The first great war was the repulse of the vast Persian empire. Although other factors, collectively more important, were at work, nevertheless. Better equipment and especially metal armor played a part in the victory; the Orientals relied much upon the bow and wore little or no armor. Probably the Greek superiority in armor indicates an economic development more intensive than that of the Orient, for armor costs money. Material however is not everything in war, indeed much of the decisive fighting was on the water where the Greeks seem to have had no superiority in equipment. The Greeks must therefore have been better seamen and land fighters than the Orientals. They may have been racially better. Their constant athletic competition must have counted for something. Although first they had feared the Persians, yet after their success the Greeks themselves said that free citizens were better men than the subjects of an Oriental despot At this point we should note that the Greeks were politically active; their cities showed a wide and shifting variety of political type; they are sometimes monarchies, sometimes oligarchies, sometimes democracies ruled by all free citizens without distinction of class, although always based upon slavery and unwilling to naturalize resident foreigners. The Persian wars were not exhausting but fruitful; their episodes were widely separated in time and each was short; the greatest—Xerxes' invasion of Greece—lasted through only two campaigning seasons.

THE importance of moral and spiritual values in war is shown by the fact that Athens, having gained most of the glory of the Persian defeats, now became the leading power in Greece although she had been the only important city devastated by the invaders. She became the chief member of a confederacy including the Aegean Islanders and the Greeks of the western coast of Asia Minor. Soon her democratic statesmen altered the arrangement to a tribute-paying empire of which she was the head. Athens however used her new position ruthlessly, and her prosperity roused the jealousy of those Greek trading cities who would not come in under her, also of Sparta, a Peloponnesian city which had long been the chief Greek land power. To this day the name of Spartan stands for heroic endurance; they were citizens of an agricultural state contemptuous of commerce and concentrated upon soldiership whereas Athens was the chief manufacturing and trading city of Greece, with the greatest wealth, the largest merchant fleet and the strongest navy.

The war of Sparta and her allies against the Athenian Empire, known as the Peloponnesian war, went on with intervals of peace for twenty-seven years and resulted in the eclipse of the first great phase of Greek civilization. Neither party was able to strike for a decision; the Peloponnesians systematically devastated Attica but did not attack Athens which was connected with her ports by means of "long walls"; while the Athenians, with their superior navy, were able to raid the Peloponnesian coast and hamper the commerce of the trading cities allied with Sparta. In the long run the more complex and brittle economic organization of Athens weakened under the strain, not being self-supporting in food she had to pay her soldiers and especially the sailors of her war-fleet, and this ended by destroying her initial superiority in wealth. Toward the end the Persians, seeing Athens a more dangerous enemy than Sparta, supported the Spartans with money; moreover, the Athenian democrats were willing to tax only the richest of their countrymen. Since navies are expensive, the Spartan alliance finally became stronger than Athens at sea and this ended the war. It is worth noting that just before the Peloponnesian war the Athenians had unsuccessfully disputed with the Persians the important grain area of Egypt; midway in the Peloponnesian struggle the Athenian expedition to Sicily, had it won, would have opened up another grain area; finally the last Athenian fleet was sent to the Dardanelles—the water gateway to the fertile plains north and west of the Black Sea.

Accompaniments of the struggle were plague within the walls of Athens among the over-crowded refugees from the devastated Attic countryside. Food became scarce, prices rose, almost everyone was in debt. So many young men had been killed or were absent on service that comic authors began to play with ideas of what the women might do if they stood together. Aristophanes' imaginary heroine Lysistrata—"The Releaser of Armies"—organizes a general sex-strike of all wives and mistresses both in Athens and in Sparta. It is true that few Athenian citizens were executed or judicially murdered. But the Athenians were ready enough to massacre revolted allies and sometimes even neutrals. The Athenian democrats after pillaging the wealthy class in their own allied cities, turned to confiscating the property of rich Athenians suspected of insufficient zeal for the war. Political office fell into the hands of low-born, unscrupulous and violent rogues. Spy-mania went hand in hand with war-fever. We hear of war-hungry profiteers and munitions makers. The greatness of Athens, the intellectual and artistic capital of the ancient world, died no clean death but basely in the foul mud of evil deeds.

For our purpose the interest of the Peloponnesian war is the social degeneration it brought. Thucydides writes (III, 82):

"So the class-war at Korkyra grew more and more savage, and it made a particular impression because it was the first outbreak of an upheaval that spread in time through almost the whole of Greek society. In every state there were conflicts of class, and the leaders of the respective parties now procured the intervention of the Athenians or the Lacedaemonians on their side. In peace-time they would have had neither the opportunity nor the inclination to call in the foreigner, but now there was the war, and it was easy for any party of violence to get their opponents crushed and themselves into power by an alliance with one of the belligerents. This recrudescence of class-war brought one calamity after another upon the states of Greece—calamities that occur and will continue to occur as long as human nature remains what it is, however they may be modified or occasionally mitigated by changes of circumstances. Under the favorable conditions of peace-time, communities and individuals do not have their hands forced by the logic of events, and can therefore act up to a higher standard. But war strips away all the margins of ordinary life and breaks in character to circumstance by its brutal training. So the states were torn by the class-war, and the sensation made by each outbreak had a sinister effect on the next—in fact, there was something like a competition in perfecting the fine art of conspiracies and atrocities. . . ." (III. 83) "Thus the class-war plunged Greek society into every kind of moral evil, and honesty, which is the chief constituent of idealism, was laughed out of existence in the prevailing atmosphere of hostility and suspicion. No argument was cogent enough and no pledge solemn enough to reconcile opponents. The only argument that appealed to the party

momentarily in power was the unlikelihood of their remaining there long and the consequent advisability of taking no risks with their enemies. And the stupider the combatants, the greater their chances of survival, just because they were terrified at their deficiencies, expected to be outwitted and outmaneuvred and therefore plunged recklessly into action, while their superiors in intellect, who trusted to their wits to protect them and disdained practical precautions, were often caught defenseless and brought to destruction."

The Peloponnesian war was only the first of a series of futile and destructive civil wars within the Greek culture. Of one of these, Xenophon, a professional soldier and a man made by war, notes the steady increase in unsettlement and disorder:

"The result of the battle disappointed everyone's expectations. Almost the whole of Greece had mobilized on one side or the other, and it was taken for granted that if it came to an action, the victors would be able to do what they liked and the vanquished would be at their mercy. But Providence so disposed it that both sides . . . claimed the victory and yet neither had gained a foot of territory, a single city or a particle of power beyond what they had possessed before the battle. On the contrary, there was more unsettlement and disorder in Greece after the battle than before it. But I do not propose to carry my narrative further and will leave the sequel to any other historian who cares to record it." (Hellenica, VII 5 fin.).

After about a century of wars between the Greek cities the population and wealth of Greece seem to have declined, not only from war but also from infanticide, abortion, and unnatural vice.

Macedonia, a half-Greek state, now became the chief power in Greece, in part because of technical military superiority, in part because Macedonia was on a larger scale than the city state and had the military advantage of strong monarchical government. Next Alexander of Macedonia rapidly conquered the entire Persian Empire; three years campaigning were enough to increase nearly a hundred fold the area subject to rulers of the Greek culture and thus to begin another great period in Greek history. Although Alexander's Empire promptly broke up, new experiments in federation were attempted; but still equilibrium was not achieved; if none of the frequent wars troubled the bases of social order like the Peloponnesian war, on the other hand the disturbances were now on a greater scale and were fought with more expensive weapons such as elaborate catapult artillery and large warships.

In the later Greek period mercenaries became more prominent. Nevertheless the citizen-soldier idea did not die out, in an emergency third century Greek cities would still put citizen forces into the field and a large part of Alexander's army were native Macedonians. Among Alexander's successors the Seleucid dynasty in Asia followed with some success a regular policy of stimulating the loyalty of their mercenaries by land grants on discharge, veterans colonies, etc. Other technical developments were an increased use of light infantry armed with missile weapons and occasional signs of increased flexibility and maneuvering power in the deep formations of the heavy infantry. The Macedonians lengthened the heavy infantryman's pike. They also made great use of cavalry, so much so that for a moment after Alexander's death cavalry and not infantry seems to have been the decisive arm—a development which, could it be fully known, might reveal important technical and social facts. It was however short lived and the heavy infantry soon regained their traditional superiority. Together with the increased wealth of the Greek world, warships greatly increased in size and siege machinery, especially catapult-artillery, became complex, abundant and powerful. Alexander used it for position warfare in the open as well as for sieges and later there are traces of its use as field artillery.

SO matters stood when a new great power, Rome, appeared.

The future mistress of the world began as a city state of the familiar type but soon became superior to other existing states not only in military technique but also in political wisdom. Technically she continued to rely chiefly on armored infantry, but used it more flexibly both in the individual fighting and in the general formation for battle. The sword, which had been secondary in Greek fighting, was made the chief weapon of the Roman legionary. For the thrusting spear with which the Greek had done most of his fighting, Rome substituted a heavy javelin intended to encumber an enemy by piercing his shield. But the chief technical discovery of Rome was in the disposition of reserves. The Greeks (although with traces of variation toward the end) were accustomed to form a single, deep and massive line—the phalanx. If the first "push of pike" failed to decide matters, the fight would develop into a series of individual combats, each man being able to drop back when wounded or severely fatigued and be replaced by his next in file. Thus there was little killing until at last the morale and formation of one side broke—after which the victors, if they chose, could massacre such fugitives as they could catch. The weakness of the phalanx was that the men immediately behind the fighting front rank were under the severe moral strain of watching more or less passively and at close quarters the bloody game in which they must soon share. Thus there was a tendency of the rear ranks to give way; they were subjected to a far worse variety of the sinking feeling known to all boxers as they sit in their corners looking across the ring at the opponent just before the call of time for the first round. Indeed panic often begins in the rear ranks or even in the rear areas, so that the rear gives way in war while the front is still firm; Napier noted this of the rear of the deep French columns of the Napoleonic time, and just before the Armistice in 1918 it was the German troops in the rear areas who mutinied and fought with their officers while the front line troops remained loyal. The Romans solved the problem by a three-line formation in which most of the reserves were spared the anguish of witnessing at the closest quarters the fighting in which they could not yet share. When wanted, they could be brought up with the impetus of a charge, the former fighting line retiring rapidly through intervals which were closed behind it, and the maneuver taking place too rapidly for the enemy to interfere with it especially as he himself must keep in some sort of formation.

Although Rome's technical military superiority was a great part of her strength, it was by no means the whole. Without her political wisdom she might have stopped almost where Sparta stopped; instead she made wise policy support her courage quite as much as her courage advanced her policy. Thus although her rich were often quarrelling with large factions of her poorer citizens, neither side ever called in the foreigner in the ruinous Greek fashion, and for centuries neither party to a quarrel would push a temporary success so far as to endanger the unity of the state. In her relations

with non-citizens her naturalization policy was broader than that of the Greek cities. She made it worth while for outsiders to become citizens and she cautiously but steadily allowed them to do so. So with those of her allies who were not—at least not yet—citizens; she made it worth while to be her ally. Indeed it was afterwards said that she had conquered the world by coming to the aid of her allies. Shortly after 300 B. C. she was the loyally followed master of a well knit federated state including the entire Italian peninsula except for the Po valley, and in less than three centuries she was mistress of the entire Mediterranean world.

At this point Rome entered upon the greatest military struggle of her history, her contest with Carthage. The latter, a north African city of Asiatic blood, was constituted as an aristocratic republic. The Carthaginians were of the familiar Semitic commercial type, they were also great sailors. Unequalled in sea power and in wealth, they ruled an empire including North Africa, much of Spain and all the Islands of the western Mediterranean except a small part of Sicily. They disliked soldiering, however, and for land fighting relied upon a professional army chiefly of foreign mercenaries.

The critical episode of Rome's wars of conquest was the second Punic War in which for the first and the last time in eight centuries the military genius of the great Carthaginian, Hannibal, made her fight for her life as an independent state. Under a great military genius, Hannibal, the Carthaginians invaded Italy, beat the Romans repeatedly, destroyed several Roman armies, and maintained themselves for fifteen years on Italian soil. Even after a century and a half—the same interval of time as that which separates us from the American Revolution—the Roman poet Lucretius is still full of the unique horror of Hannibal's war. Arguing against the immortality of the soul, he writes (III 830, etc.):

"So death is nothing to us and matters nothing to us, since we have proved that the soul is not immortal. And as in time past we felt no ill, when the Phoenicians were pouring in to battle on every front, when the world rocked with the shock and tumult of war and shivered from centre to firmament, when all mankind on sea and land must fall under the victor's empire and victory was in doubt—so, when we have ceased to be, when body and soul, whose union is our being, have been parted, then nothing can touch us—we shall not be—and nothing can make us feel, no, not if earth is confounded with sea and sea with heaven."

Plenty of modern people were in much the same state of mind in 1917-18.

OVER and above the determination of the Romans, Hannibal was beaten because hardly any of the Italian cities were willing to come over to him notwithstanding his victories. They must have felt the Semitic Carthaginians, with their gloomy and horrible religion of human sacrifice, to be profoundly alien and hateful.

The final defeat of Carthage made Rome supreme throughout the western Mediterranean. A few more campaigns made her preponderant in the eastern half. A man born in 202 B. C., the year of the crowning victory over Hannibal, dying at seventy-five, would have lived to see Rome ruling from Atlantic Spain to central Asia Minor. Another two long lifetimes saw Gaul conquered to the Rhine and the entire Mediterranean area divided into Roman provinces.

The campaigns of world conquest were carried on with the old Roman skill and accompanied by the old Roman power to assimilate conquered and allied people. In the eastern, now the Greek, half of the Mediterranean world the old city patriotisms were burnt out and there were no lasting protests against Roman rule. Nor was Rome in a hurry to stamp out the last embers of Greek liberty; occasional cities remained independent for centuries before they were at last painlessly absorbed. In the west the barbarous and semi-civilized tribes, once conquered, were well content with their new conditions. But the pace was too fast, the economic and the political changes too great, for society to remain stable. Too many of those at the top of society were half drunk with sudden wealth and power. Too many humbler Romans when, for instance as private soldiers, they saw a chance to grab a share of the swag, gulped with an equal appetite. In the chaos the unrest at the bottom of society equalled the unrestraint at the top. Throughout much of the Greek world the period of Roman conquest saw the old curse of class-war blaze up fiercely again. For the first time in history there were large slave insurrections. Later when Our Lord said "the foxes have holes and the birds of the air have nests, but the Son of Man has not where to lay his head" He seems to have been using a common popular saying or proverb found nearly two centuries earlier in the reformist political speeches of Tiberius Gracchus at Rome.

In Rome too the new chaos of unrestraint set class against class and faction against faction. For over a century faction and class hatred boiled over in civil war after civil war, each spasm usually followed by a great massacre of prominent members of the losing side. A man born shortly after 100 B. C. would have heard from his father of the fierce agitation, the riots and the political murders stirred up by the attempted reforms of the Gracchus brothers. His babyhood would have coincided with the "social war" when for the first time a large group of the Italian allies of Rome turned against her. As a boy he would have seen the ten years of war between Marius and Sulla and their fearful massacres; he might have just been old enough to fight in Sulla's last campaign. As a mature man he might have played a part in the fighting between Caesar and Pompey. In his early sixties he might have seen Caesar assassinated, and still another civil war fought between Brutus' and Cassius' factions on one side, Octavius and Antony on the other. Before he was seventy the two victors, Antony and Octavius would have quarrelled and would have fought still another civil war until Octavius had crushed Antony and had become the master of the Roman state. By this time no living man could remember a time of political stability or of peace. A passage in Vergil's "Georgics" (I 489, etc.) gives us vividly the despairing horror with which men saw the later stages of these civil wars: "Therefore Philippi saw Roman armies turn their swords against each other a second time in battle, and the gods felt no pity that Emathia and the broad plains of Haemus should twice be fattened with our blood. . . .

"Gods of our fathers, gods of our country, god of our city, goddess of our hearths who watchest over Tuscan Tiber and Roman Pallatine, forbid not this last savior to succor our fallen generation. Our blood has flowed too long. We have paid in full for the sins of our forefathers—the broken faith of ancient Troy. . . . The bonds are broken between neighbor cities and they meet in arms. Ungodly war rages the world over. The chariots launched on the race gather speed as they go; vainly dragging on the reins the driver is swept away by his steeds and the team heeds not the bridle."

No society suffering from a prolonged overdose of war can fail to understand the last sentence; all men so afflicted have felt that events had escaped from human control. The passage also shows why statesmen capable of establishing a genuine peace are popular at such times.

UNDER the name of Augustus, Octavius now reorganized the Roman state and in so doing established the first and strictest limitation of war in history. On the political side his chief innovation was to have himself elected "imperator" (Commander-in-Chief of the army) for life. On the technical military side, although armament and tactics remained much what they had been, the civil war and especially the distant conquests had changed the Roman army from a universal service militia of conscript citizens to a volunteer professional army serving for pay—and plunder. Militiamen long kept in the field must be paid or their families become a public charge, distant expeditions against enemies weaker than one's own state are best conducted by long service volunteers. Thus there had appeared the beginning of a separation between the army and the general citizen body. Just before 100 B. C., under Marius, an important step was taken: whereas formerly each soldier on enlistment was required to take an oath of fidelity to the state, he had been made to swear fidelity to his "Imperator," i. e., his Commander-in-Chief. A generation later Caesar was able to quell a mutiny merely by addressing his soldiers as "citizens" instead of "comrades."

Augustus continued the professional army but cut its numbers almost in half. Finding forty-five legions of heavy infantry in existence, he reduced them to twenty-five. If one figures a legion at six thousand men this left a possible maximum of one hundred and fifty thousand legionaries; the legion has been figured as low as three thousand. For cavalry and light infantry the Romans had come to depend on "auxiliary" units raised by their allies; normally an army would contain about an equal number of legionaries and auxiliaries. Augustus continued the auxiliary system and seems also to have continued the proportion between the two sorts of troops. Thus the entire Mediterranean world was policed by an army of not much over three hundred thousand men. In the recent war against Germany little Serbia alone mobilized over seven hundred thousand.

Of course no such tiny force could have met grave military liabilities; dangerous civilized opposition was to be feared only along the short Euphrates sector between the Armenian and the Syrian desert. There formidable foes, the Parthians and later the Persians, were to be found. But elsewhere beyond her vast frontiers there were only deserts, or northern forests thinly peopled with shifting tribes whose small numbers, lack of organization, and total lack of national or racial solidarity made them contemptible antagonists. The only pressure to be expected from them was that of mere raiding parties intent upon enjoying the fruits of civilization without submitting to the discipline which civilization must necessarily impose. An occasional defeat at the hands of the northern tribesmen in no way threatened the Roman state. To Rome such defeats were little more than the Custer Massacre to the United States or the fall of Khartoum and the death of Gordon to England. Manpower was economized by resting the frontiers on natural obstacles where these could be found, by an elaborate network of roads over which intelligence could be quickly transmitted and troops easily moved, later by lavish frontier fortification as well.

Again, the little Imperial army, stationed almost entirely along the frontiers, could not have policed so vast a state had that state been morally divided. In a negative sense the empire was unified by the absence of strong local feeling. The old city loyalties had disappeared with time, and only little Judaea had anything like a modern nationalist spirit. Elsewhere the populace was content to call the emperor a god. Indeed one cannot read poets like Vergil and Horace without appreciating that even educated men saw something godlike in the new peace of the world. Notwithstanding the excesses of the later republic, Roman administrators were not essentially oppressors—any more than British civil servants in India or French magistrates in North Africa. Just so the Roman law was inspired by a fine sense of equity and fairness. Augustus' work bore fruit in the moral unity of the Roman world.

Moreover on the technical side insurrection was less and less to be feared as time went on because the professional army system permitted the disarmament of the great mass of citizens who grew more and more unsoldierly as the Roman peace became the habit of civilized mankind.

THE Roman world continued the professional army system for no less than eight centuries; in the provinces still subject to New Rome, i. e. Constantinople, it went on for four centuries more. In the third century, however, the old plague of civil war broke out again in a milder form. The mass of men had now grown so unwarlike that any local commander whose troops would follow him had a chance to make himself Emperor; the soldiers were now almost the only "active citizens" whose support was necessary to authority. The new civil wars were not as destructive as the old; usually they were fought "over the heads" of the civilians, who were harmed only incidentally and almost by accident. At the same time the need of Emperors to conciliate the troops led to the first signs of weakening of the iron Roman discipline. Worse still, the distraction of the army by civil strife would now and then give the northern barbarians a chance to raid a province. Although these barbarians would have to run or be cut to pieces as soon as the little difficulty as to the Imperial succession was cleared up. Something of Roman civilization spread to the northern barbarians, their pressure slightly increased so that more troops had to be raised. But until after the year 400 every invasion was finally repulsed and every province was still governed directly by the Emperors.

By this time, however, the ancient world had begun to decline from within, and this decline suggests a question: had the Empire limited war too successfully? Did the necessary absence of local patriotism in a world state, together with the long continued exemption of military service of almost everyone in the Roman world, help to cause the general slackening of energy? Does vitality, at least among white peoples, flag when men are too long and too completely divorced from arms? Was the too great perfection of the Roman peace one of the reasons for the decline of ancient civilization and the descent to the Dark Ages?

Returning to the late Roman army, at the beginning of the Dark Ages two related changes came about. In the first place cavalry became more important than infantry. For centuries the Roman service had been chiefly a constabulary; in any army whose chief business is hunting brigands and raiders mobility is needed. The United States found mounted troops better than foot in fighting the plains Indians, and the

same general law is seen at work in most colonial armies. There had been a slight lowering of discipline which had been enough to destroy the offensive power of infantry; only well disciplined foot infantry will stand the moral effect of a cavalry charge at close quarters—the experience is like being on a railroad track as a train comes on. To get fifth century Roman troops to hold firm against a mounted charge, it was necessary to mass them closely and arm them with spears to keep the horsemen at a distance. In turn the close formations and the use of the spear showed a lessening of the offensive spirit. Cavalry therefore became the offensive arm.

The second change was an increase in the importance of barbarian recruitment. We have seen that the cavalry of the Imperial armies were "Auxiliaries" recruited among non-citizens; the rise of cavalry therefore meant a greater relative strength of the barbarian or "irregular" element in the Roman service as compared with the heavy legionary foot. The light armed auxiliary infantry were also more mobile than legionaries. Further, barbarians were cheaper to hire than civilized men; their standard of living was lower. They had something of the schoolboy personal loyalty to a leader so that they were apt to be faithful to their original employer in case of civil war. Finally the legionaries but not the auxiliaries were expected to build roads, drain marshes, etc.; therefore as public spirit declined the latter attracted recruits. The distinction between citizen and non-citizen recruitment seems never to have been strictly enforced.

Cavalry and barbarian recruitment increased in importance only gradually; meanwhile the Roman army remained professional and, on the whole, continued successfully to defend the frontiers.

IN the fifth century centralized administration was lost throughout the western half of the Empire. The change, however, did not come about through defeat of the Roman forces. There were great barbarian invasions, like that of Attila which must have been highly organized, but they were turned back. Except for the southern and eastern coasts of England and a belt south of the upper Danube, no savages from the outer darkness ever permanently appropriated Roman land. The leaders of the Goths, Vandals, Franks, etc., whose states appear in our historical geographies were simply hereditary commanders of auxiliary units in the Roman service. Except the Vandal, and except for Alaric the Goth during his brief and somewhat pardonable mutiny, no fifth century Auxiliary commander ever made war against an emperor; all the others took and held their power as deputies more or less vaguely dependent upon the emperors in Rome or in Constantinople. They and their units were as ready to join the Roman regulars against barbarian invaders as are the native troops of the French and British armies today. Most of them, for instance men like Alaric or Clovis the Frank, were no more barbarian than an American of today whose grandfather immigrated from Europe is European. The old tribal names of their units had become mere labels, as those units had been moved to and fro across the Empire filling up their losses by replacements first from one district and then from another. Their assumption of local government together with the breakdown of centralized administration in the west were only steps, although important steps, in a long process of the internal decay of civilization. Even when Alaric's mutinous Auxiliaries sacked Rome itself, although St. Jerome far away in Jerusalem did write, "I am at a loss for words," no other contemporary writer seems to have been greatly shocked.

At this point a question suggests itself: we have seen that the Roman world state with its drastic limitation of war involved the disarmament of the great mass of free citizens. As century followed century this mass had grown increasingly unwarlike. In the fifth and sixth centuries, notwithstanding the general insecurity which had necessitated the fortification of every city, it was difficult to get the inhabitants of a town even to mount guard on their own walls. For instance an edict of an emperor, Valentinian III, is headed "On the recall of general-dealers (wholesale merchants?) to the city," and says "We have determined that all anxiety or fear shall be removed from your minds, that the public shall know . . . that no citizen of Rome and no member of a guild is to be compelled to serve as a soldier, but only on guard duty on the walls and gates, as often as custom may demand. . . ." Is it possible that absence of local patriotism in a world state, together with the long continued exemption from military service of almost everyone in the Roman world, helped to cause the general slackening of energy? Such exemption would be complete among the upper class and the industrious middle class, for a professional army always tends to recruit itself from the cheapest human material to be found. Does the vitality, at least of white peoples, flag when they are too long and too completely divorced from arms? Did the too great perfection of the Roman peace help cause the decline of ancient civilization and the descent to the Dark Ages?

The New Submarine Plane; with Wings Folded It Is Carried in the Under-Sea Craft.

An Effective Trench Mortar

Development of the 81-mm. Stokes-Brandt Weapon

By E. C. Goebert*

THE missions of the infantry in modern warfare contain many problems for which a weapon of greater power than the shoulder rifle is necessary. The introduction of the machine gun was primarily responsible for this requirement. It brought about a complete change in the tactics of defense with the use of machine gun nests, pill boxes, strong points, etc., against which the shoulder rifle in offense is of little use.

During the World War the accompanying gun was introduced into the division organization as a solution of this problem. The accompanying gun was a light field artillery gun manned by the Field Artillery and attached to the infantry division to perform such missions of destruction of machine gun nests, strong-points and resistances as were assigned by the Infantry command. The 37-mm. Infantry gun was also effectively used against these targets. This gun was manned by Infantry personnel, was light, therefore extremely mobile, and permitted accurate shooting at close range. Its effectiveness was, however, extremely limited because of its small caliber.

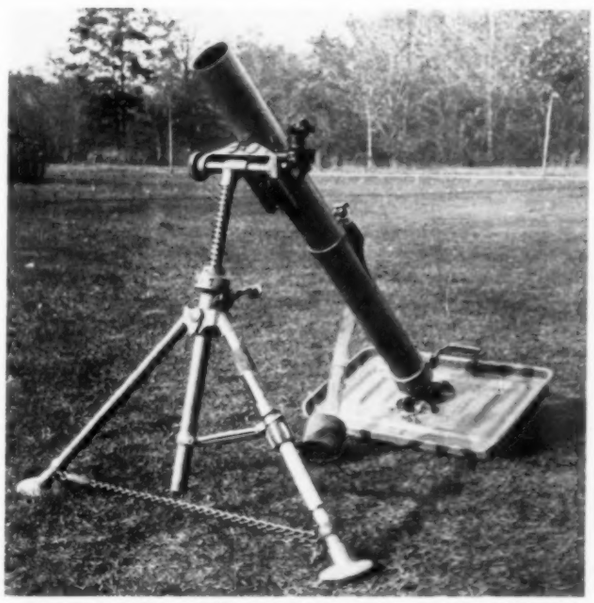

Fig. 1. The 81-mm. Mortar T4 Stokes Brandt. Model 1931.

When the campaigns of the World War stabilized into trench warfare the use of both the accompanying gun and the 37-mm. gun became extremely limited because of the low trajectory of both weapons. The need for a weapon with a short range and high angle of fall was apparent and as a result a series of trench mortars made their appearance in the lines of the competing armies. The simplest and probably the most practical of these mortars was invented in England by Sir Frederick Wilfrid Scott Stokes. On May 13, 1916, Stokes filed application for patents on his mortar in the United States. Following this, in June of 1918 he patented the ammunition which he developed for the mortar.

The United States after entry into the World War adopted the Stokes trench mortar of 3-inch caliber and equipped the Army with the weapon (Fig. 2). The complete mortar which weighed 110-lbs. consisted of three parts, the tube, weight 43-lbs.; the bipod, weight 37-lbs., and the base plate, weight 30-lbs. The weapon was readily divided into its elements and could with ease be carried by men into the advanced positions.

The mortar tube is smooth bore and is muzzle loaded. The lower, or ground end, of the tube is fitted with a closing cap which holds the firing pin. The closing cap rests in a socket in the base plate which transmits the full shock of recoil directly to the ground. The front end of the tube is supported in a split yoke on the bipod. The legs of the bipod can be adjusted to suit ground variations. The elevating mechanism in the bipod permits laying the mortar in elevation between the limits of +40° and +75° with range limits of from 150 yards to 750 yards using the original Stokes ammunition and a system of zoned fire. The traversing screw of the bipod limits the possible traverse to a total of 17°. The mortar is emplaced by cutting a V shaped excavation into the ground, the back slope of the V being at an angle of 45°. The base plate is firmly placed against back slope of the V and the base end of the mortar tube inserted in the base plate socket. The bipod is adjusted to conform to the ground and the mortar tube clamped into the bipod yoke.

Fig. 2. The 3-inch Stokes Trench Mortar Used by the United States Army in the World War.

The mortar is not provided with a sight but is lined-in in azimuth by standing behind the tube and sighting

*Chief of the Design Section, Aberdeen Proving Ground, Maryland. Captain, Ordnance Department, U. S. Army.

along a white line drawn the length of the tube on its upper side. The elevation is adjusted by setting a clinometer to the elevation desired, resting the clinometer on the upper side of the tube and elevating or depressing until the bubble is leveled.

The ammunition originally developed for the mortar is simple but crude (Fig. 3). It consists of a cylinder with a bourrelet band on each end. At the base of the cylinder is a cartridge container and at the head a booster cavity and thread for inserting the booster and an allways fuze. The ammunition is prepared for firing by inserting a cartridge similar to a paper shot gun cartridge into the cartridge container and placing the desired number of silk bag rings of ballistite around the cartridge container. The booster is then placed into the booster cavity and the fuze screwed in place.

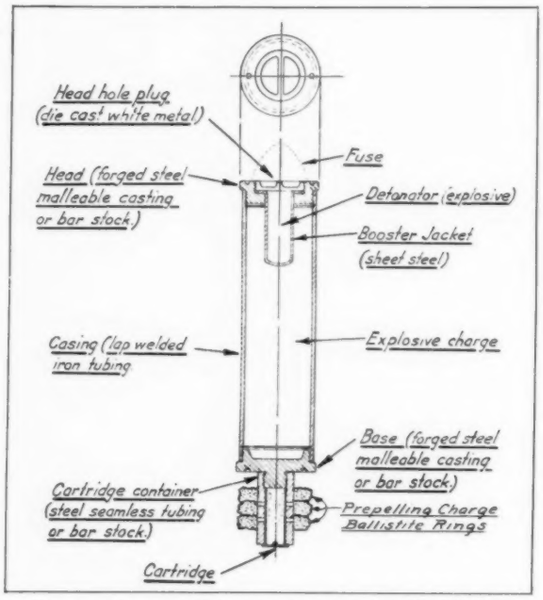
Head hole plug (die cast white metal)
Head (forged steel malleable casting or bar stock)
Fuse
Detonator (explosive)
Booster Jacket (sheet steel)
Casing (lap welded iron tubing
Explosive charge
Base (forged steel malleable casting or bar stock)
Cartridge container (steel seamless tubing or bar stock)
Prepelling Charge Ballistite Rings
Cartridge

Fig. 3. Diagram of Ammunition for the World War 3-inch Stokes Trench Mortar.

In firing the piece the ammunition is picked up with the left hand on top of and over the rear bourrelet. The right hand is placed underneath the fuze with the palm in the region of the thumb over the safety plunger. The safety pin is then pulled out by one of the squad. Standing on the right side of the mortar about on a line with the muzzle the cartridge end of the round is inserted into the muzzle and the round slid into the tube, the left hand passing over the top of the tube, the right remaining in contact with the fuze until the safety plunger is in the bore when the right hand is slid under the tube and the body rotated to the rear about the hips. The round slides down the tube, the primer striking the firing pin thus setting off the propellent charge.

The round in flight travels end over end much as a rolling pin if held by the handle and thrown through the air. The inherent inaccuracies of such a projectile can well be appreciated. However, at short ranges it is a very dangerous and effective weapon, since the 12-lb. projectile carries an explosive charge of 2-lbs. of TNT. The resulting detonation is sharp and the shell fragments into long, jagged-edged slivers which are thrown in all directions with terrific force.

The stabilized condition of trench warfare came to an end toward the close of the World War and when the infantry moved into the open the deficiencies of the 3-inch Stokes mortar were plainly evident and the need for a more accurate light weight weapon of 75-mm. or 3-inch diameter became apparent. After the war to meet this need the further perfection of the Stokes weapon was undertaken by Mr. Edgar William Brandt of Paris, France.

In the development of a better weapon Brandt adhered to the basic principles of the Stokes mortar. He recognized that his first problem was to perfect a shell which would be stabilized in flight through its trajectory. The result of his study was the design of a shell of torpedo or dart shape with fin tail (Fig. 4). The projectile weighs 7.6-lbs. and contains 1-lb. 2.9-ozs. of TNT as an explosive charge. In flight the shell travels noze-on through the entire trajectory which makes possible the elimination of the allways fuze required by the Stokes shell and the development of a point-detonating type of fuze with bore-safe characteristics.

Fig. 4. The 7.6-lb. Projectile Developed for the Stokes Brandt Mortar, 1927, Showing the Propelling Charge and Zone Charges, With Two Charges in Place.

The shell has proven extremely accurate in flight within range limits of between 200 and 3350-yards. The use of the fins on the tail of the projectile eliminated the possible use of the silk ballistite rings used by Stokes. In their place were substituted increments sealed in celluloid cups which are held in place by slipping behind clips provided in the edges of the fins.

The efficient use of the shell made necessary many refinements and improvements in the weapon. These were gradually developed and in 1927 a model was produced which was fairly satisfactory (Fig. 5). This mortar known as the 81-mm. Stokes Brandt Mortar, Model 1927, contained all the principles of the original Stokes. It was divisible into three loads: the tube, base plate and bipod. The base end of the tube was changed so that it was a ball which was held into the sockets of the base plate by means of two coil springs which gripped around the ball.

The bipod was equipped with provisions for mounting a collimator type of sight for laying the mortar in ele-

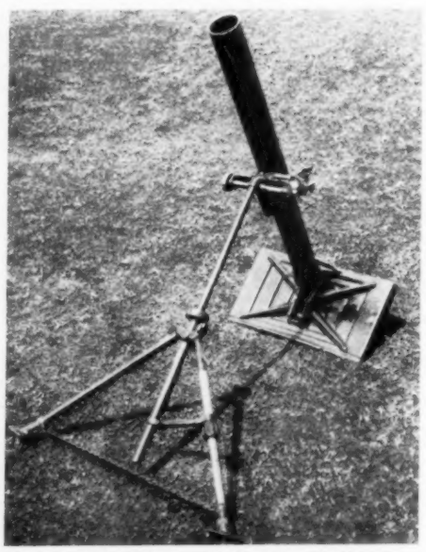

Fig. 5. The 81-mm. Stokes Brandt Mortar, Model 1927.

vation and azimuth. To eliminate the effect of the shock of firing on the bipod and the sight, a double acting spring buffer was imposed between the yoke which holds the mortar tube to the bipod and the bipod proper. The bipod was further refined to permit cross-leveling of the piece on any reasonable type of ground. The base plate was so designed that it could be placed upon the ground without excavating. The mortar is placed in firing position by dropping the base plate on the ground in the desired location, pushing the ball at the end of the mortar tube into the socket in the base plate, setting the bipod and clamping the mortar tube to the bipod.

THE development of the mortar was further continued and in 1931 the latest model was produced. Four of these mortars were purchased for test by the United States Army and are known as the 81-mm. Stokes Brandt Mortar, T4 (Fig. 1). The principal changes in this mortar as compared with the 1927 model are in the base plate, the bipod and the sight.

Following are some of the general characteristics of the weapon. The tube weighs 48 lbs. 6 ozs; its length is 49.9 inches; its outside diameter 3.75 inches. The base plate weighs 43 lbs. 4 ozs. The bipod weighs 33 lbs. 6 ozs.; it has a traverse of 130 mils at 45°, 145 mils at 60°, and 210 mils at 80°. Elevation is from +40° to +90°. The total weight is 124 lbs. 13 ozs.

The base end of the mortar tube is ball shaped flattened on two sides. The tube is fastened to the base plate by inserting into the socket in the base plate in its proper relation and turning 90°. The base plate has been carefully ribbed and designed to give the greatest possible stability when shot into the ground since it was found that for rapid fire the close grouping of the hits was greatly dependent upon the firm holding of the base plate.

The bipod consists of two tubular steel legs mounted on the elevating screw housing (Fig. 6). The spread of the legs is limited by a chain fastened to the bottom end of the legs. In the left leg there is a hook into which the links of the chain can be caught to regulate the spread. A spring is interposed between the right-hand end of this chain and the right leg to relieve the legs of firing shocks. The elevating mechanism consists of the elevating screw, elevating nut, gear pinion and handle. To the top of the elevating screw is attached the traversing nut. The traversing screw passes through this nut and is mounted in a bracket to which is fastened the spring recoil buffer to which in turn is mounted the split yoke which clamps the mortar tube to the bipod. A metal firing data disk for the 7.6-lb. projectile is riveted to the clamping yoke. The sight is mounted on the left-hand end of the traversing screw.

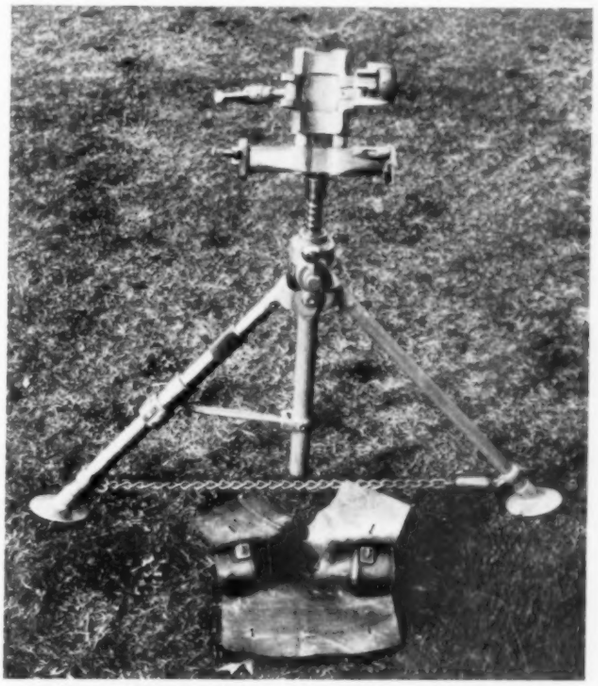

Fig. 6. Bipod and Cover for the 81-mm. Mortar T4.

The left leg of the bipod is equipped with a threaded sleeve free to travel up and down the leg controlled by a knurled brass nut at its upper end. On a sleeve is mounted a sliding collar to which is fastened an arm connecting the collar to the bottom of the elevating screw housing. The collar is clamped on the leg of the bipod by a slotted hand nut which, to cross-level the traversing screw, is slid up or down the leg. In cross-leveling by this method the elevating screw is placed in a perpendicular plane when the traversing screw is in a level plane.

The sight is a ruggedly constructed, simple collimator type. It is adjustable for both traverse and elevation. It can be swung through 180° to enable back sighting when ground conditions require this method of laying. The elevation scale is graduated from 40 to 90° in 1° intervals. The traversing scale is graduated in 200 mil increments with the micrometer adjustment further subdividing this into 2 mil increments.

The requirement existed for a projectile heavier than the 7.6-lbs. for demolition purposes with this weapon so that there has been developed a 14.5-lb. projectile having an explosive charge of 4-lbs. 6.6-ozs. of TNT (Fig. 7). With this projectile the mortar has range limits of from 220 yds. to 1300 yds.

Fig. 7. Center: The Large Projectile (14.5-lbs.) Developed for the 81-mm. Mortar T4. At Left the Full Charge is Shown in Place, and at Right the Unfolded Fins.

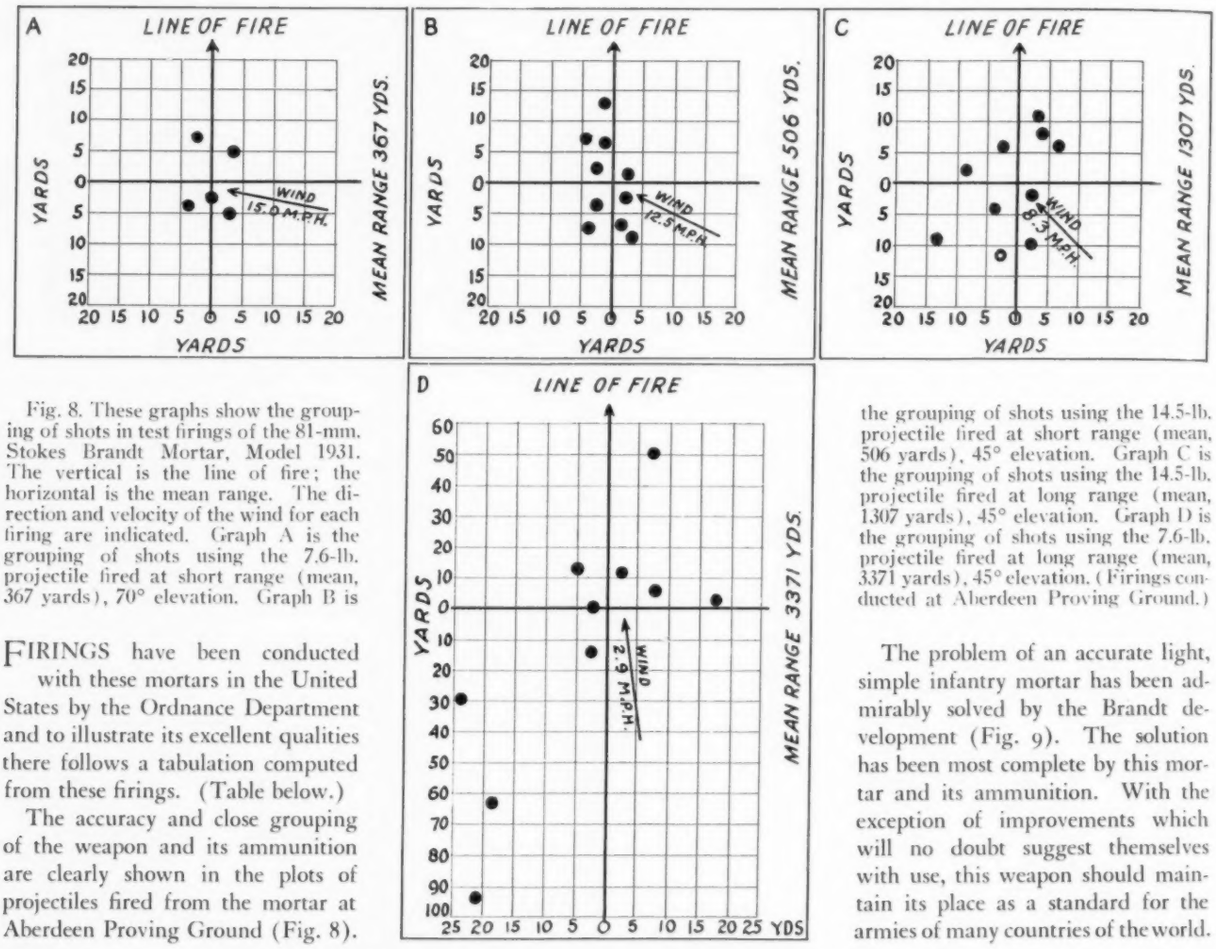

Fig. 8. These graphs show the grouping of shots in test firings of the 81-mm. Stokes Brandt Mortar, Model 1931. The vertical is the line of fire; the horizontal is the mean range. The direction and velocity of the wind for each firing are indicated. Graph A is the grouping of shots using the 7.6-lb. projectile fired at short range (mean, 367 yards), 70° elevation. Graph B is the grouping of shots using the 14.5-lb. projectile fired at short range (mean, 506 yards), 45° elevation. Graph C is the grouping of shots using the 14.5-lb. projectile fired at long range (mean, 1307 yards), 45° elevation. Graph D is the grouping of shots using the 7.6-lb. projectile fired at long range (mean, 3371 yards), 45° elevation. (Firings conducted at Aberdeen Proving Ground.)

FIRINGS have been conducted with these mortars in the United States by the Ordnance Department and to illustrate its excellent qualities there follows a tabulation computed from these firings. (Table below.)

The accuracy and close grouping of the weapon and its ammunition are clearly shown in the plots of projectiles fired from the mortar at Aberdeen Proving Ground (Fig. 8).

The problem of an accurate light, simple infantry mortar has been admirably solved by the Brandt development (Fig. 9). The solution has been most complete by this mortar and its ammunition. With the exception of improvements which will no doubt suggest themselves with use, this weapon should maintain its place as a standard for the armies of many countries of the world.

Type of Projectile	Elevation in Degrees	Mean Range Yards	Mean Deviation Range Yards	Mean Deflection Yards	Mean Deviation Deflection Yards	Mean Velocity
T1— 7.6 lbs.	75	549	5	.4 R	2.4	351
T1— 7.6 lbs.	75	1616	30	36.8 L	26.4	696
T1— 7.6 lbs.	45	3371	38	2.9 L	12.7	687
T3—14.6 lbs.	75	625	6	8.3 L	6.9	386.9
T3—14.6 lbs.	45	506	6	.9 L	1.4	227.3
T3—14.6 lbs.	45	1307	7	1.4 L	4.8	386.9

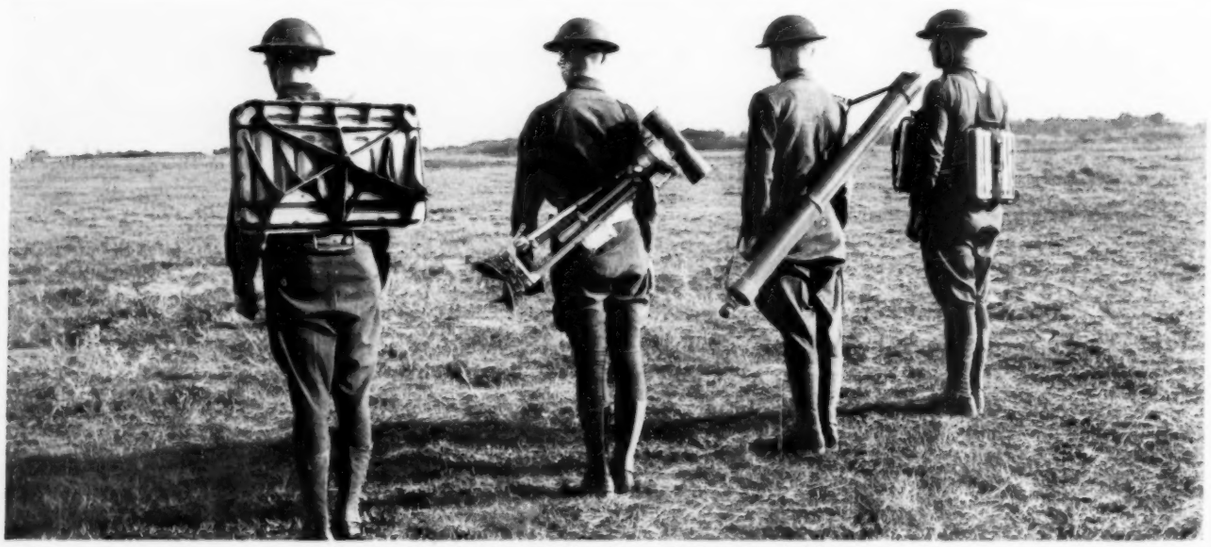

Fig. 9. Squad Carrying the 81-mm. Stokes-Brandt Mortar.

A Plea for the Defense

With Some Aspects of the Attack

By R. P. Gatehouse*

IT is not too much to say that of the Principles of War, as described in Field Service Regulations, none receives such consideration in the British Army as does that of offensive action. It is our greatest doctrine, and is continually quoted and insisted on. In fact, it may be considered that the normal action of the average officer, when faced with a problem of which the solution is at all in doubt, will be of an aggressive character.

The reason for this state of affairs is, no doubt, the fact that "The ultimate overthrow of the enemy demands offensive action," and it is held that the inculcation of the doctrine of the attack, by preaching and by practice, is continually necessary to achieve the offensive spirit required for the attainment of the desired end.

It is submitted that the word "Ultimate" receives insufficient notice, and that there has been some misjudgment of the national character.

The possibilities of any major war in which Britain may be engaged opening with an offensive on her part may be taken as practically non-existent, and a brief glance through the history of such conflicts will show that her forces have usually been compelled to carry out more or less prolonged defensive actions in the opening phases.

It is logical to suppose that this will also apply in the future, especially in view of her traditional and common-sense policy in Europe which places her inevitably on the weaker, and therefore on the defending, side.

It can hardly be maintained that the extended defensive actions in the past have prevented the British Army from adopting final and successful attacks. History is full of examples to the contrary and the reason is this; that a successful defense breeds—particularly in the British—the desire to attack more certainly than does the aspect of a waiting enemy. Troops who have been pounded and attacked, but have seen the enemy continually recoiling before them, are imbued with an almost irresistible desire to advance to the assault, and when they are permitted to do so, the vigor and élan of their attack are unsurpassed.

The obvious danger of unbridled offensive actions has brought about the dictum that troops will not be launched to the attack without adequate support. This dictum is prompted by the soundest principles, but a serious difficulty arises in its application, since opinions as to what is adequate support vary in a marked way. Moreover, such support, in those cases where an officer of junior or middle rank has the power of decision, is unlikely to be forthcoming with the present proportion of supporting arms.

There can only be one answer to the question as to what an officer will do who, on the one hand has been imbued with the doctrine of attack, and, on the other, is not quite sure whether he possesses sufficient support to come within a law of a necessarily vague description.

A British vanguard composed, for example, of an infantry company with a section of guns and a few machine guns will, as matters now stand, carry out an immediate and wholehearted attack against an equal enemy. A French vanguard, on the other hand, is intended merely to reconnoiter and to transmit information, as it is maintained that disproportionately high casualties will be incurred by expecting a force so weakly supported to drive in the opposing advanced troops by a hurriedly prepared attack.

In 1914, after the Battle of the Marne, the Germans found it impossibly costly to advance, owing to the inadequacy of their supporting arms, against the British fire of rifles and the two machine guns per battalion the latter then possessed. Since those days automatic fire has increased by some two thousand per cent, while the supporting artillery can show a growth of about forty per cent—a proportion unpromising to the attacker.

It will, no doubt, be immediately objected that this makes no allowance for armored fighting vehicles or for improved methods of attack. These points will be considered in some detail later, and it will be sufficient for the moment to state that methods of defense have also improved, and that the truest and most fundamental teaching of military history is that aimed fire has, considered over extended periods, proved the decisive factor in battle. The aimed fire of the breechloader swept the heavy column off the earth; the aimed fire of the magazine rifle denied the battle front to the mounted man; and the aimed fire of the machine gun now drives the infantryman underground. It is to be expected that ultimately the aimed fire of the antitank gun will also be supreme. In this connection it is noteworthy that the tank owes its origin to the necessity, not for avoiding fire, but for resisting it. In this it temporarily succeeded, but the final result of the projectile versus armor contest is a foregone conclusion in favor of the projectile.

In fact, one is inevitably led to the conclusion that the solution of the problem of attack lies not so much in the type of troops that will carry it out as in the prevention of aimed fire by the defense. If this can be accomplished, almost any form of soldier, foot, horse or motor, can advance to the attack. If not, then it is submitted that no type of fighter will move on the battle front.

That the need for upsetting the close aimed fire of the defense is realized is unquestionable; that it is considered the absolute essence of the problem is not so certain. If it is, then it would appear that adequate steps to accomplish it have not been taken.

LET us consider the possible methods of preventing this aimed fire in so-called mobile war. They appear to be as follows: (1) Obscuration; (2) Action against the nerve and material of the defense from a distance; (3) Attacking from a direction towards which the aimed fire of the defense is not prepared.

As regards the first, reasonable means of obscuration resolve themselves into the hours of darkness and the production of

*Captain, British Army. This article is published by arrangement with the Editor, "The Fighting Forces" (London).

smoke screens. For present purposes the night must be eliminated, because however useful night attacks may be for minor objects and in exceptional circumstances, the experience of all soldiers is to the effect that their scope is too limited to achieve important success under normal conditions.

The smoke screen may undoubtedly prove effective, but it possesses some very serious disadvantages. Firstly, it depends on a favorable wind, for which "mobile" operations can scarcely be expected to wait; and secondly, the necessity for successively blinding the defended localities in depth will result in the whole area becoming enveloped in smoke, which will militate against the necessary control in the same manner as, though in a less degree than, the hours of darkness.

As regards the second method, much enlightening evidence is available, all of which goes to show that when sufficient artillery and mortar fire is present with which to strike at every portion of the area to be attacked, no efficiently aimed fire is possible, and the attacking troops arrive, with little opposition, at their objective. It has been found by experience that no portion of the defense must be omitted from the bombardment, because the fire of very few unshaken machine guns may wreck the most powerful attack, and because it is impossible to foretell or to discover where all the defending machine guns are placed.

It is sometimes held that in mobile war such an extensive barrage as is thus indicated is unnecessary, and that with careful consideration the probable areas of the defending automatic weapons may be deduced. It is suggested that to launch a main attack with the security of probabilities only is a gamble where the results of failure are murderous, and that it is not practical politics in war. It would appear that the odds are definitely against a correct forecast. Von Moltke, in one of his few humorous moments, stated that he had noticed that there are always three courses open to the enemy, and that he invariably takes the fourth. We also have the Great War as evidence, where, in spite of the unrivalled opportunities for discovery by means of the most extensive air reconnaissances and photography, the work of patrols through many nights, powerful telescopes, close-up observation posts, and the interrogation of prisoners captured in frequent raids, it was held that the possibilities of concealment were such as to necessitate an intense barrage. It can scarcely be maintained that in mobile war, with comparatively little time available, with fewer airplanes, and with no extensive earthworks to indicate the general areas occupied, it will be possible to rely on shelling those areas only in which it is considered probable that the enemy has placed his most powerful weapons.

It may be objected that the tank, with its increasing efficiency, can be substituted for artillery fire on suitable portions of the front. It has already been indicated that, if there is any logic in history, the tank will require as much protection against the antitank gun as the infantry at present needs against the machine gun. It is not, of course, intended to give the impression that the tank is superfluous on the battle front; far from it, for as a means of rapidly carrying automatic fire into the enemy zone and of destroying obstacles to the infantry advance, it is unrivalled.

We now come to the third method, which resolves itself into either a true tactical flank attack, or a turning movement which seeks to strike at the reserve and headquarter area by entirely avoiding the battle front.

IT is interesting to consider the history of the past seventy years in this connection, a period which is selected as representing the phase during which military thought and education approached an approximate equality among the leading nations. Previously there had been such inequality that useful lessons are difficult to identify. It is, for example, somewhat useless to examine Napoleon's conduct of operations against the Austrians at Ulm with a view to similar exploits against a modern European enemy. Important lessons for modern theoretical purposes can, in the main, be deduced only from operations in which the opponents are approximately equal.

It will be noticed that during this period examples of flank attacks or turning movements successfully carried through are so rare as to represent very abnormal occurrences. It must be here stated that a true flank attack is not equivalent to an enveloping movement such as the Prussians undertook in 1866. There, the widely separated Prussian wings aimed, not at striking actual flanks, but at advancing in such directions that the success of their attacks, which would naturally be met frontally, would result in the ruin of the Austrian Army by the severing of its communications.

One would suppose that the American Civil War, fought by comparatively small armies in very extensive territory, would be full of examples of successful flank attacks. Such is not the case, however, and in the very few instances in which a flank was actually struck, such as at Cedar Creek and Chancellorsville, the ruin of the defender was not accomplished. Even Grant, with his undoubted ability and great numerical superiority, was unable to strike Lee's flank in the wide Virginian Lands. He attempted this maneuver repeatedly, but everywhere he was opposed by a line of entrenched Confederates, and became goaded into frontal attacks. If this is the case when a great disparity of force exists, an approximate equality in total strength—including leadership—would seem up to the present day to place a successful flank attack on the list of phenomenal occurrences.

The reasons for this state of affairs are not far to seek. Firstly, a commander is very nervous as to his flanks, because he realizes that a real enemy success there will ruin him, and he accordingly takes every precaution against such a disaster. Secondly, the attack, even if it actually strikes a flank, always appears to lose momentum too rapidly, and for this reason that a graph illustrating the relative strengths on the threatened flank would show a great initial superiority on the part of the attacker, but a final advantage to the defender on account of the speed of reinforcement conferred by interior lines.

It remains to consider whether or not the latest productions of military science have sufficiently overcome these difficulties in the conduct of a flank attack.

IT is widely held that the great progress in the mobility of an army brought about by mechanization will not only enable a sufficient force to be brought against a flank in so short a time that the defender will either be unaware of it or unable to meet it in time, but also that the speed with which the actual attack will advance will more than neutralize the advantage to the defender of interior lines.

It is submitted that this school of thought is wrong in both respects.

Firstly, it must be noted that, great though the progress

of military mobility may have been, there are other spheres of equal importance in which even more progress is recorded. Chief among these for the present purpose is the collection of factors included under the heading "Intelligence"; this comprises not only the vastly improved facilities for collecting information, such as aircraft, balloons, large civil populations, and highly organized intelligence services, but also increasingly rapid means of transmitting the information obtained by the use of radio-telegraphy, wireless telegraphy, civil telegraph services, fast motor vehicles and aircraft. It is only natural that greater progress should be made in this direction than in the mobility of an army, because whereas armored fighting vehicles, carriers, dragons, etc., have but little bearing on the civil life of nations, and even six-wheeled vehicles are by no means universally adopted, the methods of obtaining and transmitting information are closely connected with, and are mostly absolutely essential to, the progress of ordinary civil requirements. The advantage, in fact, will lie with the seekers for information rather than with those endeavoring to withhold it.

To maintain that the speed of the attack which has succeeded in striking a flank will prevent the defender from supporting the threatened area in time is to infer that the defending troops are of an inferior type to their adversaries. When equality is admitted the relative position remains as in the past, and the advantage in final reinforcement must remain with the interior lines in the hands of a capable commander who has foreseen the possibilities. Furthermore, such a flank attack, even when delivered by completely armored forces, will not take the form of one rapid and shattering advance without warning. Armored fighting vehicles are more sensitive to ground than any other troops, and will be equally sensitive to fire, with the result that reconnaissance must be very thorough. Also, the advance must be by bounds, otherwise the force will arrive at contact with the defending reserves in a disorganized condition, and in no state to engage in a decisive battle.

That a flank movement by mobile troops will avoid sufficiently early discovery by the enemy is unlikely for the reasons already given, but there is a further disadvantage in this respect if large numbers of tanks are used. Should the country be suitable for such machines—i. e., open and rolling, either the machines themselves or their tracks will inevitably be disclosed to aërial reconnaissance. If the country is not so suitable and is enclosed, then not only will the full power of such troops be lost, but the ground reconnaissance and counter measures of the defense will be greatly facilitated.

For these same reasons a wide turning movement which aims at avoiding the battle front altogether, and which depends for its success on a rapid and concealed advance, must be classified as a forlorn hope. It is worth examining such an operation, in its aspects other than those of observability, from the point of view of the commander-in-chief. Firstly, it must be borne in mind that such a movement must be carried out in the early stages of a war, for this reason, that the speed with which modern organized nations can get their full national strength into the field is great, but requires a considerable degree of stability on the fighting front. This stability and the resulting arrival of great forces, spell the end of such mobile operations.

Now the opening phases will find an army but poorly equipped with armored fighting vehicles owing to their great cost, their lack of commercial value, and the financial difficulties with which the Powers must continually be confronted. They represent the greatest striking force of all, and are therefore of inestimable value. Will the commander-in-chief have the temerity to employ them on such a doubtful exploit, however attractive the prospect? Would he even contemplate it if he considered that the opposing commander may become aware of their movement, and, when they are past recall, may employ his own in coöperation with his artillery and infantry to smash the battle front? A good strategical position is no compensation for a tactical disaster.

One is therefore led to the somewhat depressing conclusion that a successful flank attack or wide turning movement will be at least as abnormal as in the past, with a probability that they will be even more so on account of the present equality of military ability among the leading Powers. That such operations, if successfully accomplished, will still produce the greatest results is undeniable, but it must be expected that an attack in the case of reasonably equal opponents will develop into one of a frontal nature, and the main consideration should be the methods by which a frontal attack can be carried out.

SPACE does not permit of a detailed examination of the requirements of a frontal attack. It may, however, be stated that there is considerable evidence—supported by theoretical calculation—to the effect that a main frontal attack, on an organized enemy requires, for covering fire alone, at least three times the amount of artillery that is normally allotted to a formation. A brigade needs the whole divisional artillery, and a division demands three divisional artilleries.

Further requirements such as counter-battery fire, the blinding of observation areas, and harassing fire indicate the necessity for a vast quantity of artillery for the support of one main attack on a "decisive" scale, altogether apart from the needs of other portions of the front for defense and for "pinning" the enemy.

The situation thus appears beyond the scope of the British Army at its present strength in artillery, but even supposing the necessary amount to be available, what type of warfare is it that would permit of the deployment and preparation of such a force? Is mobile war placed outside the bounds of ordinary probabilities? In this connection it is interesting to recall the views of M. Bloch, the Polish banker, on the course of future wars. They were astonishingly accurate as regards the Great War, but they were not confined to that struggle only; he referred to warfare of the future. He foretold extensive immobility.

It is therefore suggested that the action of the British Army in war against an equally equipped enemy should be an initial defensive with a view to a counterstroke at the moment of maximum enemy disorganization, when the requirements of supporting fire are not so overwhelming, and when full advantage can be taken of our undoubtedly great progress in the manufacture of armored fighting vehicles.

IT is possible that the great and successful efforts in the production of tanks have led to some misconception as to their ability owing to the absence, as regards the British, of similar visible results in the manufacture of the antitank gun, and to the belief that they will supply the means whereby war may be kept in a mobile condition. It should not be lost sight of that, as stated above, the *raison d'être* of the tanks was the desire to resist fire rather than to avoid it;

in fact, they almost invited small-arm fire, thereby reducing that directed against the more vulnerable infantry. This resisting power now appearing doubtful, their increasing speed has brought about a belief that they will be able to avoid it, and this view is possibly fostered by the omission to issue a really efficient antitank gun and to produce a sound antitank organization. No doubt such guns are withheld until a more or less final pattern is approved and the best organization arrived at. When this is accomplished it is possible that the general view of the tank question will be considerably modified, but meanwhile perhaps something is lost to the education of the army as a whole by a failure in a proper appreciation of the matter.

That the tank is fast enough to avoid the aimed fire of the defense is, to say the least of it, doubtful. On the Aldershot or Salisbury plains, every inch of which is known, they may be able to cruise about at twenty miles an hour, but over country that has only been looked at from a distance, closed for action and with the details of the defense unknown, if they maintain twelve miles per hour they will do well. This can scarcely be fast enough to avoid the close aimed fire of the most efficient automatic, pivoted guns that science can produce, especially if their operators are unshaken by the heavy fire of the artillery.

The writer is not antagonistic to the tank. The contrary is the case, and nothing more is intended than an attempt to show the limitations of tanks and, in his opinion, their proper uses.

THERE is one additional matter that appears to hamper the search for the best method of attack, and that is the definition of the climax of the battle. It is usually accepted in the army that the climax is the infantry assault with the bayonet. Although this phrase is now omitted from Field Service Regulations, the doctrine has never been untaught, and, in fact, expressions still used in that volume give the impression that it is still in force. For example, in Section 10 we find that "The main object of the infantry, to which all other operations are preliminaries, is to close with the enemy and destroy him," and "Finally to overthrow the enemy by the employment of the bayonet." Section 60 states that it must be "The aim of every commander so to combine the efforts of the component parts of his force as to ensure that his infantry reach their objective in the best possible condition for engaging in close fighting." According to the general interpretation of these passages, the aim of all the science of the world as applied to war, and of the intellect brought to bear on military problems, is to bring a man suffering from an advanced state of physical and nervous exhaustion into a position in which he is expected to use the least powerful of all killing weapons.

It is suggested that the true climax should be the entry into the hostile position of the most powerful of all weapons—the machine gun—with which to destroy the enemy if either retiring or holding positions on the flanks, and that all other operations, including the bayonet assault, should be but means to that end.

It may be said that the advance of machine guns is always attempted. Perhaps it is but unless it is looked upon as the only true object it is likely that the methods of its attainment may not be the very best that could be devised. The tank is a very suitable machine for this purpose, but it may not be the best. Further experiments alone can discover the best means of bringing the machine guns into position.

In conclusion it must be said that although it has been suggested that the British Army is unsuitable for the attack of an organized position in "civilized" war, it is not intended to give the impression that the practice of the methods of attack is useless. The majority of Britain's wars will be fought against inferior enemies in the "upkeep" of the Empire; the advocated counterstroke in a great war, requires the employment of the principles of attack; and it may be possible that more guns will be available by the time the next great war commences. It is, however, suggested that more credit might be awarded to the defense, and that the "thruster" who lacks in circumspection should be somewhat curbed.

It was Napoleon's view that a sound offensive starts from a sound defense. This may be taken both intellectually and for practical leadership. The beginner should first become proficient in defense and protection.

An Important Element of the Defense.

Antiaircraft and Tank Practice in Germany

A Cardboard Plane for Antiaircraft Practice.

At left an operator is shown controlling from a tower by means of cables the movement of a small cardboard plane constructed to scale and serving as a target for the gunners (right). Under the terms of the Versailles Treaty the German Army is not permitted to use military aircraft and antiaircraft equipment and the quantities of arms, ammunition, etc., allowed are strictly limited.

Jig Saw Puzzle Tanks.

Sheet-iron and cardboard tanks used in German maneuvers. At left the sides and turret are being assembled on the small car; at right man-power-propelled "tanks" are executing a maneuver. As in the case of aircraft, tanks are not permitted the Reichswehr under the Versailles Treaty which subjects all German armament to periodic supervision and inspection by the League of Nations.

American Military History

A Plan to Meet A Real Need of the National Record

By C. C. Benson*

THEODORE ROOSEVELT, speaking about American military history at Boston on December 28, 1912, said: "I know my fellow countrymen, and I know that no matter what general resolutions they come to in advance, no matter what the lack of preparations, they would go to war on the drop of a hat if the national honor or the national interest was seriously jeopardized. The way to prevent the possibility, therefore, is to keep ourselves, our whole military system, the Army and Navy as part of the whole military system, in such a condition that there won't be any temptation on the part of anyone else to go to war with us. You can't do that unless you make our people wake up to the real meaning of our past history."

To "make our people wake up" to the real meaning of our military history is especially difficult. Many of our citizens are satisfied with histories that recount only our ultimate success in every war in which we have engaged. There are others, of pacifistic tendencies, to whom military history is a subject for avoidance rather than study. They may consider the study of military history to be antagonistic to their aims; but it would appear that, under present world conditions, efforts to promote peace must take into account the facts about war. The human factors that make for war have not disappeared; they recur in both hemispheres as strongly today as at any time in the course of recorded history. Many nations are crowding each other in their struggle for existence; some are seething with revolution. Wars are now in progress in various parts of the world, and have been continuously since the close of the Great War which was to have ended war. War is not a latent disease; it is a virulent pestilence. To limit its ravages, and to avoid having our nation subjected thereto, are the heartfelt wishes of every American. Despite the fact that war would bring to our professional soldiers opportunities for increased rank, pay and reputation, those who have experienced the horrors of war sincerely desire peace. Both military and nonmilitary advocates of peace are here on common ground. If both can find secure footing on this common ground, there is hope that peace movements will develop along lines that hold the greatest promise of success.

The surest way to guarantee continued peace for the United States is to develop in the American people a broad knowledge of the facts of our military history, and an appreciation of their true significance. Let them know how close this nation has come to the brink of disaster; in addition to exploiting our triumphs, dwell on the humiliating defeats that we have suffered. Failure to investigate thoroughly our military history, and to apply its teachings, has added to our public debt billions that might otherwise have been devoted to the maintenance of peace. Before, during and after each great national emergency, we have repeated many of the costly errors that could have been avoided had experience been our guide. If our people could but know the truth, it would constrain them to recoil from war until there is, with honor, no alternative. All the peace societies in the world could do no more. Instead of antagonism between students of American military history and those who advocate peace at any price, there should be close coöperation.

It is essential that we know the strength and weaknesses revealed by our past military experience. This experience should be studied, in its proper relation to economic, social and political factors, as an integral part of our national life. It involves not merely the strategy, logistics, organization, training and tactics of military forces; it involves an analysis of our national growth, and of the attitude of our people towards their federal government, towards their national military system, and towards foreign nations whose interests have conflicted with our own.

The work necessary to the proper study of our military history includes four distinct operations: (a) assembling historical evidence; (b) preserving the evidence; (c) writing history; (d) publishing and distributing historical material. No one agency, official or otherwise, is capable of performing efficiently all of these operations; nor is it desirable that any one of them should undertake the whole task.

TO establish historical facts, it is necessary to assemble evidence, evaluate it, and then, from a study of all available data, to deduce the truth. The evidence required may be in the form of an authentic contemporary written document, map, photograph, an article of uniform or equipment, field fortifications, and so on in endless variety. The important thing is to bring together in one place as much evidence as possible, in order that personnel trained in modern historical methods may evaluate it, index it, and prepare it for the use of students and historians.

It might be supposed that the evidence necessary to cover the comparatively brief period of our national life would be readily available; but that is not so. In the Congressional records, the printed official records of our Civil War, and in many unofficial publications pertaining thereto, we have a wealth of documentary source material for that war. And there are, in various publications and museums, fairly complete and reliable data on the Revolution. The same can not be said about our Hundred Years War with the Indians, the War of 1812, the War with Mexico, the Spanish-American War, or the World War. Until the evidence relating to each of these wars is assembled, evaluated, and made available for research, the facts can not be established, nor can the lessons of our past wars become known.

How necessary it is to assemble the evidence is indicated by the efforts of the 1st Division Association to complete the World War records of that division. Soon after arrangements were made in 1927 for representatives of this association to examine the official files, it became evident that there were great gaps in the records. Important field orders, situation maps, operations reports, and similar documents were missing. They were found, after diligent and systematic search, in other official files; among the current records of

*Historical Section, General Staff. Major, Cavalry, U. S. Army.

1st Division units; and in the possession of individuals. The search was made by former members of the 1st Division who were well acquainted with its war-time personnel and operations. They wrote thousands of letters and made hundreds of personal visits. Curiously enough, sergeants who had served at battalion and regimental headquarters were able to produce carbon copies of many documents for which no originals could be found. The official 1st Division files originally filled nine filing cabinets; when the job was done, there were nineteen.

The experience of the 2d Division Association parallels that of the 1st. Their initial efforts along this line preceded those of the 1st Division, and blazed the trail. One brigade of the 2d Division was composed of Marines; consequently, it was necessary to search the historical files of the Navy Department and the Marine Corps files at Quantico, Virginia, where this brigade was demobilized. Had the former members of the 2d Division not been determined to complete their records, and willing to support the project with approximately $5,000, the work could not have been carried on.

THESE examples have been cited to show the unsatisfactory condition of the official historical records of typical World War units. The assembling of World War records is still practicable because so many of the participants are living. They can be reached by mail or personal visit; and, on the whole, are seriously interested in helping to preserve the history and traditions of their units. Even for the World War, however, the situation is rapidly changing for the worse. The papers of deceased veterans fall into unappreciative hands, are mislaid, consumed by fire, eaten by mice, are simply thrown away or otherwise destroyed. It will not be long before the great mass of the documents in the possession of individuals has passed beyond the hope of recovery. That condition now applies to many of the scattered records of our prior wars.

Although official records will usually provide the backbone of our military history, much additional evidence must be assembled. Official documents are generally too restricted in scope to meet the historian's needs; an order, for example, states what certain troops are to do, but the commander's reason for issuing the order must be sought elsewhere. It may be found in his diary, in personal correspondence, or in the private papers of officers who were on duty at his headquarters. For periods in which small groups of observant educated people lived in isolation on the frontier, as Army garrisons commonly did during our Indian Wars, the casual letter of an officer or lady may establish facts of great value to historical research. The private correspondence of George Washington is invaluable as historical evidence on many matters connected with our early military history. Similarly, the letters of Gen. Robert E. Lee to his wife throw much light on certain events of the Civil War. The diary kept by Gen. Charles G. Dawes, and published in 1921 under the title "A Journal of the Great War," contains historical material of primary value that can not be found in official documents.

The assembly of this nonfederal but none-the-less authentic evidence presents a serious problem. This material includes letters sent and received, diaries, account books, drafts of reports and studies on military and nonmilitary subjects, miscellaneous notes and memoranda. Some of it is probably assembled now, in the archives of state and other historical societies in this country, where it could be reproduced or consulted; but no one knows exactly where to look for the remainder. Even when found, the present owners may be reluctant to part with it, or to permit the unrestricted use of documents that reveal the intimacies of family life. These obstacles can often be overcome by returning original documents after true copies have been made; and by safeguarding certain papers through suitable restrictions. Typical restrictions that might properly be imposed are that ownership is not relinquished; that examination will not be permitted during the lifetime of the donor; that the documents may be examined only by serious scholars or upon specific authorization of the donor. Persons who are justly proud of the achievements of their ancestors should regard it as both a duty and a privilege to deposit historical papers where they will be preserved for the future use of historians. The principal difficulty is the lack of a responsible central agency of unimpeachable standing that could undertake to assemble this nonfederal material.

Little can be said, without over-extending this discussion, about evaluating evidence and making it available to students and historians. These additional steps must be taken to complete the assembly. When the Historical Section, Army War College, completes its present primary task of assembling, collating and indexing the official historical records of World War organizations, it will know what records are missing and will have ready for use a directory for all the important documents that are now in the files. The experience of the Historical Section in evaluating evidence contained in organizational records, shows that this work should be done by those who have a broad background of military experience and knowledge—in general, by officers who are qualified for duty on the General Staff. Their work on official records should be supplemented, in the nonfederal field, by that of qualified civilians and retired officers who are especially interested in our military history. Anyone who has attempted to dig out facts on a particular subject from a mass of documents, will appreciate the value of having all the pertinent evidence indexed in advance.

The task of assembling this evidence falls naturally into three parts. That connected with the official service records of individuals belongs exclusively to The Adjutant General. That which deals with the official historical records of organizations is, as stated in Army Regulations 345-105, the particular concern of the Historical Section, Army War College. The assembly of all nonfederal evidence relating to important individuals and to organizations, must be entrusted to a nongovernmental agency which has yet to be created. To insure progress there must be complete coöperation between responsible and competent agencies. The most urgent historical task that now confronts these agencies is to assemble such evidence as is readily available, and then to search out more, before it is destroyed.

THE necessity for preserving the evidence needs no discussion; this is simply a question of who is to do the work. The Adjutant General is the legal custodian of official War Department records, and should remain so. The Historical Section, Army War College, is made responsible for assembling the official historical records of organizations, because this work can best be done by an agency which makes it a primary function. These records must be set-up separately from those pertaining to routine administration and personnel; but they should be kept under the official custody of the Adjutant General. Thus, they are available for both admin-

istrative and historical purposes until they are ready for transfer to the Federal Archives Building.

Legislation governing the transfer of records to the Archives Building has not yet been enacted; but the building is now under construction in Washington, and we may reasonably anticipate that it will be in operation within two years. Hearings on bills that have been introduced in Congress indicate that deposits will be strictly limited to the official federal records, and that the documents will generally be fifty years old when they become eligible for admission. Once they are in the Archives Building, the official records will be more completely safeguarded than would be possible elsewhere.

Preservation of nonfederal evidence is another matter. Assuming that an assembly of this material is to be made, as it must if we are to know the truth, adequate facilities to preserve it must be provided. It finds no proper place in the files of the Adjutant General; nor will it be admitted to the Archives Building. Some of it might prove acceptable to the Library of Congress where it would be classified, indexed, safeguarded and held under any reasonable conditions that the owner might prescribe. As the funds available to the Library for these purposes must be applied to manuscript collections of outstanding importance, most of the nonfederal evidence pertaining to our military history must be housed and cared for by a nongovernmental agency. Until that agency is properly established, there can be little progress towards this objective.

THROUGH the control that a government has over its archives, it can influence the writing of military history. It may restrict the use of its material so that only facts which support a predetermined viewpoint will come to light. This course has been pursued so consistently by some nations that their "official" histories are now regarded as mere propaganda. No matter what precautions are taken, the truth turns up from some unsuspected source. The action of our government in publishing the records of the Civil War without comment, has been widely recognized as the greatest contribution to the study of military history that any nation has ever made. Our policy has been to make all the important evidence readily available, and to let historians use it as they see fit.

Though many of the more spectacular episodes of our military history have been admirably presented by various historians, no history has as yet been written that adequately covers the whole field. Once the evidence is ready to use, there will be as many different histories written as there are military historians. Many will be written by civilians, and it is highly desirable that this should be so. There are some things that must be said, which would come with poor grace from military men. They can not, with propriety, criticize Congress, the President, the Executive Departments or the American people for their shortcomings. These matters should be left largely to civilian historians.

There are, however, many phases of our military history which must be handled primarily by military men. Under the provisions of Army Regulations 345-105, which require the preparation of organization histories, certain officers have acquired some experience in writing military history. In addition, the Army War College, the Army Industrial College, and the General and Special Service Schools have seriously undertaken the study of military history. These factors operate to educate Army officers in the methods of historical research, and to make them appreciate its high professional value. Thanks largely to a good Army school system, our Army is better prepared to undertake its share of this work than it has ever been before. Some of these historical studies will deal with special and technical subjects; others with broader subjects such as the coördination of land, sea and air forces; the control of manpower, munitions and finance in war; the selection of proper strategic objectives; and methods of coöperating with allies. The responsibilities of those entrusted with these studies will be great, for decisions that control the expenditure of large annual appropriations will result from their work.

The possibility of collaboration by military men and civilians on the most important parts of our military history should not be overlooked. If such collaboration could be arranged, it would provide the most favorable conditions for first class work. Professor R. M. Johnston of Harvard has enumerated four qualifications that he considers essential for the writer of military history, i. e.: technical knowledge of the military art, erudition, critical skill, and literary skill. To find a well-balanced combination of these qualities in an individual, soldier or civilian, is rare; but in a properly organized group, the best qualifications of both elements would be in mutual support. If a group of qualified officers and civilians could be *permanently* organized, with adequate financial resources, it would provide the stability and continuity that are essential to the planning and execution of extensive historical projects. There will be need for just such an organization as long as there is need for an American Army.

THERE are several routes that a military author's manuscript may take to appear in print. The manuscript must first be submitted to the War Department, and authority obtained for its publication. It may be published privately, in which event the author pays the cost of printing and distributing his product. Military men can rarely afford this luxury. Commercial publication affords another route. To find a publisher who will assume the expense of publication and distribution is difficult. Few worth while books on military history have a sufficiently wide appeal to justify their publication commercially. As commercial publishers must make profits if they are to remain in business, they are seldom eager to publish military histories. The third route to publication is through subsidization. Should an officer write, for example, a meritorious History of American Cavalry, he might persuade the Cavalry Association to publish it. Neither the author nor the Association could expect to profit financially; but both would have the satisfaction of having contributed something of value to the service. The fourth route is through the Public Printer, who publishes and distributes "official documents" for all branches of the federal government. Military historical studies may reach him through the efforts of Congressmen or through the War Department. The size of each edition is fixed by law or by the sum that the Department can devote to a particular project. War Department funds for printing are so limited, and current demands for technical and administrative publications are so great, that but few crumbs fall from the table to nourish the publication of historical studies.

The War Department can not issue an "official" history without assuming full responsibility for its contents and the manner in which the material is presented. Whenever it does so, it has to weather a storm of abuse because of the

expressed or implied criticisms that a truthful history is sure to contain. Current War Department instructions to the Historical Section, Army War College, on the writing of historical narratives, prescribe: "The narrative of facts will contain no comment, estimate, comparisons or conclusions." The publication of narratives thus written may serve some purposes; but would it not be better for the War Department merely to publish the official records?

It would appear that the publication and distribution of military histories can best be managed by a noncommercial organization that is entirely independent of the government. Such an organization could collect and disburse funds for historical work, and could integrate specific projects into a broadly conceived plan. What might be accomplished is well illustrated by the "Chronicles of America," published by the Yale University Press. With a definite, coördinated plan of this kind, covering our whole military experience, it should be possible to secure the necessary funds from interested individuals and societies to publish and distribute the books on American military history that the American people should have. Lacking such an organization, progress on this work will continue to be haphazard.

THERE are in the United States hundreds of historical societies, including national, state, county and local organizations. Two of them, the Military Historical Society of Massachusetts, and the Naval Historical Foundation, are of special interest to us. The former, organized in 1876 by the distinguished military historian, John Codman Ropes, has rendered invaluable service to students of our military and naval history. Its publications, library and museum contain materials that greatly facilitate research.

The Naval Historical Foundation was incorporated in 1926 under the laws of the District of Columbia, with its objects defined mainly as: "The collection, acquisition, and the preservation of manuscripts, relics, books, pictures, and all other things and information pertaining to the history and traditions of the United States Navy and Merchant Marine, and the diffusion of knowledge respecting such history and traditions." Supported largely by regular contributions from the United States Naval Institute and occasional sums from interested individuals, it has operated on a modest scale and has gradually built up its resources. Among other things, it has sponsored the preparation and publication of an accurate history of the Revenue Cutter Service, in accordance with the terms of a bequest made with that end in view. Its greatest value has been in providing a rallying point for the diversified activities of those who desire to foster the history and traditions of our Navy.

What is being done for our naval, economic, political, social and religious history, can and must be done for American military history. A permanent nongovernmental organization is essential for this purpose. It might be possible to organize a military history branch of an existing national organization, such as the American Historical Association; but it would probably be better to create an independent society which could later affiliate with that Association. Government agencies, such as the Library of Congress, the National Museum, the Smithsonian Institution and the War Department, have done and are doing military historical work; but no one of them is in position to coördinate this work. Some of the things which can best be accomplished by a permanent nongovernmental organization, may be summarized as follows:

1. To make detailed, comprehensive and coördinated plans for work on all phases of our whole military history.

2. To affiliate with organizations that are willing to coöperate.

3. To consolidate data on the location and contents of deposits of source materials pertaining to our military history that now exist in governmental archives, libraries, museums and historical societies, both in this country and abroad; and to facilitate the use of these materials.

4. To assemble, collate, index and preserve all the pertinent nonfederal historical evidence that can be found.

5. To establish a National Military Museum in Washington, D. C., which would serve as headquarters for the organization, provide proper housing for its archives and educational exhibits, and facilitate the research work of students and historians.

6. To arrange for the collaboration of military men and civilians in the writing of a complete series of first-class military histories.

7. To subsidize the publication and distribution of these histories.

8. To develop in the American people a broad knowledge of the facts of our military history, and an appreciation of their true significance.

The establishment and maintenance of such an organization will require ample funds. Some financial assistance may be expected from interested civilians; but the responsibility for initiating and carrying on this work will devolve upon active and retired Army officers. It may be difficult at present to assemble funds for all eventual purposes, but there is no immediate need for large sums. The project can be launched and maintained for the first five years on the income from $100,000. There will be time enough to seek additional financial resources after the organization has perfected its plans for the future. To provide a definite basis for discussion on this subject, it is proposed that there be established a noncommercial corporation—The American Military History Foundation—whose principal business and objects will be as outlined above.

This proposal has received serious consideration during the past two years from a group of active and retired officers in Washington, D. C. After consulting with a number of distinguished military and civilian historians, they have drawn up tentative articles of incorporation for the proposed Foundation, and have drafted its constitution and by-laws. If the publication of this article evokes sufficient response to warrant the formation of a permanent organization, a meeting for that purpose will be held in the near future. All who desire to coöperate in the further development of this project are invited to communicate with Lieut. Col. Charles E. T. Lull, Chief of the Historical Section, Army War College, Washington, D. C.

EDITOR'S NOTE: Brig. Gen. Geo. S. Simonds, Commandant of the Army War College, has issued the following statement in respect of the above article: "In my opinion the proposal with which this article concludes offers a sound and practicable solution of the problem presented which merits the careful consideration and support of officers of the Army and all others interested in a comprehensive and accurate recording of the facts of American Military History." ARMY ORDNANCE adds its commendation to the proposal and hopes that it may speed the day when the long neglected history of American armament, complete in all its details, will be available.

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Month by Month

Secretary Swanson of the Navy is doing a very sane and commendatory thing in his efforts to have naval construction included in any national program of public relief work that may be adopted. Commenting editorially on the Swanson proposals, *The Washington Post* makes the observation that few activities offer so many advantages to labor as ship construction. The Secretary estimates that $85.00 out of every $100.00 spent for naval construction goes to labor. The same advantages and the same distribution of money spent apply with equal force to the construction of military armament. In all sincerity we offer the suggestion that if definite action is to be taken on any sizeable program of public expenditure for emergency relief, then the modernization of the military equipment of our fighting forces should be considered in the light of job relief. Indeed we present it as more than a suggestion; we urge it as a step equally advantageous to job relief and to the national defense. While most people feel that drastic reduction of public expenditures and a consequent lowering of the tax burden are essential to restore normal economic life, it seems that a temporary relief program will be approved. If so the connection between ordnance and job relief should receive consideration.

Ordnance and Job Relief

To say that "failure" must be written across a startling portion of the plans and activities undertaken by the federal government in recent years to relieve the pressure on many cogs of our economic machinery is putting the case lightly. In one relief category alone—that of the farmer—remedial legislation has been nothing less than gigantic waste. According to the chairman of the Farm Board, the estimated losses from the Board's stabilization and other operations since its establishment are placed at about $350,000,000. The figures for some of the relief projects which have shared in public funds may eventually be of the same proportions. Just why it is that the average individual when he thinks of public projects turns without fail to federal buildings, concrete highways, bridges, tunnels and bathing beaches is difficult to understand. Loans of public funds, even though they are loans, have been lavishly bestowed upon enterprises which impress some of us as "self-liquidatingly" far-fetched.

True enough there are many enterprises of a purely relief character which demand and are worthy of public support. We are confident, for instance, that the Conservation Corps will have a splendid effect—indeed a very necessary effect. Its mobilization during these days presents the heartening picture of a glorified Citizens Military Training Camp in action. The mere citizenship phase of the project with the added prospect of employment for thousands of young men under healthful and disciplinary auspices in the open country—all these suggest a public undertaking of the highest value. Maybe, too, the proposed relief measures of the Government will mean the eradication of the old sore spots in many of our larger cities. Prosperity did not blot them out, adversity will have done real good if some of the city slums begin to disappear. But in addition to such undertakings there are crying needs of national defense which should not be overlooked.

To return to Secretary Swanson's proposal, it is a fact that few if any other activities provide as large a return to labor as does ship building. The same can be said for all military equipment and as to some kinds of it the proportion of return to labor is even greater. Take the case of ordnance for the Regular Army and National Guard. The cost of fabrication is the big item; the cost of material is so-to-say small. The situation is no different from any other engineering and manufacturing enterprise. But there is an important added consideration. We are making no claim that is not well known to informed observers when we call attention to the woeful state of our military machine insofar as its equipment with up-to-date matériel is concerned. We have developed automotive vehicles, guns—large and small—and ammunition of the most modern and effective types. Our Army has initiated these developments and sponsored them. But for lack of money it has never been able to procure more than a mere handful for its needs. A casual visitor to a military reservation has ample evidence that our Army is drilling and maneuvering with antiquated equipment. In the inaugural parade of 1933 the services made a splendid showing in men but considering the old antiaircraft guns that were trotted out—for lack of anything more modern—the display did not show the admiring throngs any 1933 models. In the face of splendid engineering achievement our Army in every one of its major components still is equipped and trained with matériel of World War vintage.

Often we have said blunt things here concerning the popular mind which permits the national defense to be jeopardized so seriously. What possible good reason is there why our Army is not using the latest types of automotive vehicles, antiaircraft batteries, field guns, semiautomatic rifles, machine guns, ammunition and all the appurtenances that go with them while money is spent rather lavishly in every direction for things which, at times, have doubtful value? Heretofore the cost of any project for the rearmament of the Regular Army and the National Guard has been frowned upon by legislators. Yet no avenue of public relief contains as many advantages as this.

Assume, for the sake of definiteness, that the Swanson proposal is adopted for ship building and that a similar program is made effective for military equipment. The benefit to labor will be immediate and far reaching. Industry which

now lays prostrate would have a backlog of public support to start its wheels turning again. Orders for the new standard types of tanks, armored cars and trucks for the Army now would be a godsend to labor and the automotive industry. Replacement of field and antiaircraft guns and their ammunition with current types would be starters for labor and the machine tool and steel industry. Re-equipment of the Army with semiautomatic shoulder rifles would be a blessing to labor and our struggling small arms industry. Renewal of ammunition would help return payrolls to normal size in the chemical and metal trades. Related to all these is the demand for jigs, dies and fixtures for present and future production and here again labor gets the lion's share of the money spent.

The plea of Colonel Hodges in this issue of ARMY ORDNANCE that educational orders be undertaken now as a priming agency for industrial recovery sounds a clarion call which should not go unheeded. When educational orders were sponsored several years ago as a means of acquainting industry with the difficulties of ordnance production we talked in terms of a million dollars a year for ten years. Even today such an expenditure would be better than nothing and educational orders are still sound in theory and in practice if they are ever to be practiced. But with world and domestic conditions as they are, with expenditures for public relief an accepted policy, with labor and industry pleading for work and the national defense crying for modern equipment, the opportunity to kill two birds with one stone is as clear as the noonday sun. Job relief and the national defense are eagles in our aviary of problems.

The need for naval and military construction is not open to question from a domestic standpoint. For Navy expenditures the fact is that we are far below treaty limitations; for the Army we are even farther below a sensible supply of modern equipment so neither field offers the rest of the world cause for concern. Internationalists may rail at the idea but what of it? We should be awake to their tactics by this time. Embarkation upon building-up programs for the Army and Navy with the return involved for labor and industry is job relief and priming for recovery in their most efficient form and there is double consolation in the plan for Americanism. We have no reason to believe that any sums spent for these purposes will go to waste ever—now that the public mind is awake to the fact that conditions at home are more important than world problems.

Furthermore, we on the home front are not so sure that the saturation point as to public buildings and highways has been reached in many localities. Our reasonable needs of modern armament will still serve their peace insurance purposes when new Federal court buildings are half empty and there are no Eighteenth Amendment litigants to fill them, when improved highways in remote areas are little traveled and bus-truck competition with railroads is made not so remunerative. The pinch of necessity has modified our national outlook quite materially; by some it is considered a blessing in disguise. The blessing will be complete and most beneficial if it changes the national outlook on the need for military and naval rearmament as a boon to unemployment relief, to industrial recovery and to the safeguarding of the peace. Friends of the national defense have stood back while all sorts of panaceas requiring huge public expenditures have been brought forth. If the policy of public expenditure for relief is to continue let us help put our house in order by providing relief for the artisans of our engineering and industrial establishments by building a treaty Navy now and by building the tanks, the armored cars, the antiaircraft and field guns, the rifles and ammunition our skeleton Army needs so badly. For present consideration the share of labor in the cost is 85 per cent; for future consideration the share of the taxpayer is 100 per cent because the taxpayer's dependence on the national defense is just that much.

The New Commanders and the Old

A CHANGE of administration in the national government is probably as complete an example of the peaceful flexibility of our American system as any other one function prescribed by our Constitution. The people's mandate, with all that it portends for the future and all the stimulant which change of leadership itself brings in its wake, presents old friends of ordnance preparedness in power and other old friends back in the ranks. To those who on March 4, 1933, took up their new responsibilities the military service and civilian friends of the national defense extend the same high degree of coöperation and loyalty that were accredited their predecessors. Differences of party have no place where the national defense is concerned.

The tidal wave of popular approval which has greeted President Roosevelt in his urgent economic undertakings since he assumed office has but added to his record as World War Assistant Secretary of the Navy and as Commander of the New York National Guard during his terms as Governor of the Empire State. His achievements during the World War for our first line of defense and his sane support of things military recall the days of another Roosevelt in the White House when a strong Navy and an efficient Army were synonymous with Americanism. Already there are indications that our first line of defense under the present administration will not lack the support its efficiency demands.

ARMY ORDNANCE on behalf of the Association which sponsors it, extends greetings to the new Chief, Secretary of War, former Governor George H. Dern of Utah. Born in Nebraska sixty years ago, he won his laurels on the miniature battlefield as captain of the Nebraska Football Team, the Missouri Valley Conference Champions, in 1894. In that year the family moved to Utah where the future Secretary developed an interest in mining, eventually becoming general manager of the largest gold mine in the state at Mercur. Elected to the State Senate in 1914, he served for two terms during which he introduced and sponsored many progressive measures including workmen's compensation, mineral leasing, etc. In 1924 he was elected Governor of the State and reelected in 1928. During the World War he was a member of the State Council of Defense.

Members of the Army Ordnance Association also take pride in the honor and great responsibility which have come to a member of the Advisory Board of the New York Ordnance District, the new Secretary of the Treasury, Hon. William H. Woodin. Mr. Woodin, as President of the American Car and Foundry Company, has been an exponent of industrial preparedness for many years. A native of Berwick, Pa., and a member of the School of Mines of Columbia University, class of 1890, he entered the service of the American Car and Foundry Company in 1889, becoming president in 1916. The record of his great industrial organization is written large on the pages of ordnance achievement during the World War. His administrative ability during war days and his achieve-

ments since that time, as well as his handling of the tremendous problems which greeted him the moment of his accession to the Secretaryship of the Treasury, are the things which his ordnance associates have grown to expect of him.

Also to be included in our felicitations is Governor Herbert H. Lehman of New York, a charter member of the Association. Governor Lehman entered the Ordnance Department on October 1, 1917, with the grade of captain, and served first in the Equipment Section of the Procurement Division. In July, 1918, he was detailed to the Purchase and Supply Branch, Purchase, Storage and Traffic Division of the General Staff. Upon his return to civil life after the war he had attained the grade of colonel in which capacity he has held a commission in the Ordnance Reserve Corps since 1921. His interest in ordnance affairs has always been an active one despite the great public responsibilities which have come to him in recent years. During his service as Lieutenant Governor of New York his allegiance to the ordnance cause was unfailing and his associates of the organization are confident that as Governor of New York the zeal, energy and devotion which have always characterized his national defense service will redound to the public benefit.

Notwithstanding the change in leadership which has brought these and other friends to power, those who have relinquished the command of the national defense take with them abiding thanks and congratulation. It was a tribute in itself when former Secretary of War Hurley could leave the War Department with the Army in such a high state of efficiency, and when former Assistant Secretary for Air F. Trubee Davison relinquished his post with our air arm at its highest point of progress both in men, aircraft and training. For the former Assistant Secretary of War, Col. Frederick H. Payne, we reserve special commendation. The A.O.A., of which he is a charter member, the Ordnance Reserve, in which he is commissioned a colonel, the Bridgeport Ordnance District, where he performed so splendidly during the World War, and all believers in industrial preparedness know full well the high caliber of his work and its lasting effect on this important part of the national defense.

To the new leaders a hearty welcome and success; to the old, sincere thanks and congratulations.

Disarmament Plans Ad Infinitum

AFTER thirteen months of fruitless discussion the Disarmament Conference several weeks ago heard Premier James Ramsey MacDonald of Great Britain outline another British plan of action. It takes its place with the subsequently announced Mussolini plan, the Hoover plan, and others. More may come of the Premier's 10,000-word plan than from the others. The Conference adjourned for a month, until April 25th, to resume again with the British draft as a basis. The Premier's presentation was frank and statesmanlike to the point of being itself disarming. "Come on," he said to the assembled delegates to the Conference, "you have done jolly little. Come on—get away from all these feminine follies."

The 96 articles of the British draft cover the entire scope of military strength. France, Germany, Italy and Poland would be allowed 200,000 "effectives" each. Effectives is the Continental gloss for plain, ordinary "soldier under arms." Because of their overseas possessions France and Italy would have in addition 200,000 and 50,000 "Colonials" each. Russia would have 500,000 troops, a cut of some 60,000 under present strength. Germany's allotment of effectives would double her present size while the others would be lowered.

As to armament, the British plan includes some of the Hoover recommendations, changes others and adds some. The main provisions are embraced in a series of limitations, prohibitions and distinctions. Tanks would be limited to a weight of 16 tons, coast defense guns to a caliber of 16 inches, mobile guns to a caliber of 105 millimeters and although 155-mm. guns now in existence would be retained, no more would be produced and all larger calibers would be destroyed. Additional matériel to be destroyed—all of which would be accomplished within three years after the 5-year treaty became effective—would include all military airplanes in excess of 500 each to be allowed Britain, France, Italy, Japan, Russia and the United States. A great deal of wholesale destruction is implied here. Britain would scrap some 900 ships, France about 1800, Italy approximately 1,000, Japan about 1100, Russia, roughly 250, and the United States about 1200. Another prohibition includes all incendiary, bacterial and chemical warfare and "bombing from the air would be completely prohibited, except for police purposes in certain outlying regions."

This, like another of those artificial fiats with which Americans are more familiar, reads like a "noble experiment." We wonder how the Premier's plan will be received even at home. The Oxford Union will swallow it hook, line and sinker, so will the boycotters everywhere. But for that great mass of the Premier's compatriots we believe the poet's challenge "Lives there a man with soul so dead, who never to himself has said 'This is my own, my native land' " will govern. We surmise that enthusiasm for anything which scratches the surface merely and does not go down to the roots will not be over powering. The British do not generally deal in effects, forgetful of causes. We do not think they will on disarmament. Their experts are too well versed for that. However, experts are unknown quantities as well abroad as they are here, because everybody except the trained and experienced military man is expert on disarmament.

What Will the Cork-and-Needle Tactics Be?

TWO articles in this issue of Army Ordnance describe revolutionary developments in the shoulder rifle and ammunition which bid fair to effect the whole future of warfare. In his discussion of the Gerlich rifle and bullet Major Wilhelm describes a method of obtaining high velocities while Major Hatcher presents a study of the principles of operation of automatic firearms. The significance of these subjects cannot be overstated. For years nothing radical—and the term is used in its best sense—has been proposed in the method of operating automatic firearms or in the design of an improved ammunition. Now a new field of possibilities opens up, from it the rifleman may emerge in the stature of old. His weapon, the shoulder rifle, is on the road to equality, if not superiority, to the new factors of conflict which for some years now have tended to deprive him of his advantage. After thirty years of painstaking application the semiautomatic shoulder rifle begins to step into the place of the trusty Springfield—that certainly is radical as things military go. And, in addition,

the high velocity weapon reappears to threaten the armor and match the speed behind which the knights of the twentieth century now take cover.

With regard to the Gerlich rifle and bullet Major Wilhelm tells an American audience what some of our foreign contemporaries have already told theirs. Heretofore the Gerlich rifle and bullet have been discussed in these pages mainly as to their effects. Causes may be described now without violating the proprieties because over-seas publications have begun to speak out. Thus none of the information contained in the Wilhelm text arises from any official sources but only from authentic data published in the technical magazines abroad. What Major Wilhelm writes of the Puff method is a matter of long standing record to small arms specialists generally. In this we have a principle which makes possible a remarkable increase in velocity.

In the second, and concluding part of Major Hatcher's article, which will appear in the next issue of this Journal, he will describe the unusual and successful way in which an even more radical change in the operation of automatic firearms may come about. The genius of a young mechanic, David M. Williams of Godwin, North Carolina, now operates the massive mechanism of the Browning machine gun with the caliber .22 cartridge! This design allows a tremendous increase in the power available from a cartridge to operate an automatic arm. Whether the Williams method of operating automatic arms proves successful for larger calibers, inasmuch as it may provide too much power, remains to be seen. At least the semiautomatic has progressed along conventional lines.

We who stand by and observe must come to a clear conclusion. Revolutionary changes today are not confined to banking, economics and the enjoyment of Constitutional beverages. They are working just as surely and as definitely in the field of defense and attack by the man in arms. The big question is what can we do with these forces? Will we take them for what they are worth and put them to use? Most assuredly what is written in these two articles is evidence that the technician is hard at work with success in the offing. The tactician may well prepare himself for the day when the semiautomatic and the high velocity rifles are put into his hands. He would do well now to determine the new responsibility that will be his. The single shooter will soon be *passe* and the cork-and-needle bullet is on the horizon. Tacticians, give the command "Double time!"

Gloom on the Mechanized Front

LONG distance observers are at a loss to account for the "demechanization" of the mechanized brigade of the British Army just when students of the new order had concluded that the British mechanized brigade was treading the untrodden paths with marked success. This step backward in infantry organization has cast gloom over the mechanized front. American readers, in the light of the study published in the last issue of this Journal by Capt. B. H. Liddell Hart, saw in the British mechanized brigade what appeared to be the most forward-looking undertaking in post-war development throughout the world. In the absence of a complete statement of the reasons and future attitude toward the mechanized brigade, friends will hope that the move is a temporary one and that army economy rather than a changed army outlook is the reason behind it.

In its pioneering along the undeveloped terrain of mechanization the British Army in 1928 converted two Infantry brigades, the 6th at Aldershot and the 7th at Tidworth, to a new semimechanized form. During the past four years the exercises of these organizations have been of marked value not only to the British service but to students of the new order everywhere. Under the recent decree it appears that the 6th Brigade is to return to the old horse-drawn form while only the 7th will carry on the mechanized experiments.

We gather from the published accounts that officers generally are "discussing the retrograde step with concern and wondering what it means." The infantry is deprived of an invaluable tonic, and the prospect for the mechanization of the remaining thirteen brigades is at best gloomy. When the experiment was initiated the two brigades were reorganized to consist of a battalion of light tanks and three infantry battalions each with its machine gun company mechanized. After a year the light tanks, because of their impairment by being tied too closely to the infantry, were withdrawn but the infantry battalions continued with their machine guns in Carden Loyd armored carriers and their transport motorized. Later on their fighting power was increased by the addition of a platoon of motors. Now it appears that this organization which has obviously done so much for the new era of battle tactics is cut in two, one half of it going back to Victorian style. It looks as though if money is not the reason that the defense rather than the attack may be coming to the fore in Britain.

By way of contrast to this important occurrence overseas is the refreshing announcement that the Chief of the Militia Bureau of our service has been authorized to convert immediately a number of Field Artillery units of the National Guard from animal-drawn to motor-drawn equipment. The units to be converted are the 51st Field Artillery Brigade, 26th Division (Mass.); 68th Field Artillery Brigade, less headquarters battery, 43rd Division (Maine, Connecticut, Rhode Island, Vermont); 60th Field Artillery Brigade, 35th Division (Nebraska, Kansas and Missouri); 61st Field Artillery Brigade, 36th Division (Texas); 70th Field Artillery Brigade, 45th Division (Colorado, Oklahoma, New Mexico, Arizona), 104th Field Artillery (New York); 116th Field Artillery (Florida); and Brigade Headquarters battery, 56th Field Artillery Brigade (Florida). It is understood that when conversion of these units has been completed authority will be granted for extension of the program to additional units.

While this feature of our program is fraught with the greatest significance in that it is one more step up the ladder of mechanization and consequently is a good indication that the use of the motor in war is going forward, still we wish there were something to parallel and even to carry on here the studies so splendidly undertaken by the now defunct British brigade. Its passing, if permanent, is a wet blanket on the new order.

International Debts and Territory

SOMEHOW our diplomats have assented to rules of international procedure which have caused the debt stalemate. The muddle exists only because of the rules.

In any bargain, each side desires something which the other side has to exchange. If this were not so, there would be no transaction. When the war debts were contracted for by the Allied nations, they wanted munitions and we wanted to secure the profits to be derived from the manufacture and sale of munitions in our country

to them. As the principal was guaranteed by powerful friendly nations, the bargain was highly satisfactory to both sides.

Why were we satisfied by the guarantee of these nations? Certainly because of the great domain over which they exercised control, because of their great populations of energetic peoples, because we believed the fight they were making was justified according to our interpretation of international propriety, and because we were confident of their honesty in matters of money and credit. The debts were contracted to be paid in gold at the expiration of definite times. The use of the funds, which represented our labor and goods, were to be paid for at agreed rates of interest in gold. We must have known at the time of the loans that there was not enough gold in the world to pay them. We must have understood that gold is only useful as a measure of labor and goods and that the payment of principal and interest had to be made in large part by this equivalent of gold.

When the time of payment drew near we decided we were unwilling to accept the equivalent of gold because we could discover no way of using this equivalent to our advantage. By a new series of agreements we extended the time of payment and reduced the amounts to be paid for our own advantage. But even with this new arrangement there was not enough gold available to the debtors. If we collect all the gold they receive they will have no convenient means of exchange, no measure of value for labor and goods, and their trade by which new capital is created will languish. We are accordingly again confronted with the question of receiving labor and goods instead of gold and we have not made up our minds to receive them. As long as we persist in our refusal to receive the equivalent of gold, we must extend the time of payment, reduce amounts of payment or otherwise temporize the situation.

We have argued with our debtors that they ought to reduce their security, liquefy some of their armament assets in order to obtain gold to pay us. It seems to us that we are undertaking an unwarranted interference in the business operations of our debtors if we ask them to reduce their insurance of existence for our benefit. Our own enormous war potential existing in our 125 million homogeneous population, in our unlimited natural resources, in our great industrial development, in our secure boundaries, and in our power of organization, demonstrated during the World War, regardless of our small military forces and our naval strength, of our own volition reduced to a parity with Great Britain, all this is a remote reason for European armament. The presence of Russia, still uncertain as to her future and in the midst of the world's greatest social experiment, is a sufficient reason also. We dare not press the matter of armament reduction very seriously without endangering the very existence of the debtors and the total loss of all our loans, especially during this period of great unrest all over the world.

Let us go back a moment for a look at one of the rules to which the diplomats seem to have assented, that one which assumes to say that land and people can no longer be considered as real estate to be transferred from one sovereignty to another. In the last issue of Army Ordnance we proposed the cession of certain territory belonging to Great Britain which could readily be valued in terms of gold and could be transferred to our jurisdiction in lieu of gold shipments in satisfaction of a national debt. Examination of the territory transferred from German sovereignty after the World War has convinced us that this method of settlement should not be neglected. We recommend that the exchange of territory be connected with the subject of international debts at the earliest opportunity and that our country recede from its position of connecting limitation of armament with this question of international debts now and forever.

A Super Submarine

WITH enough fuel to take her half way around the world, Great Britain's new submarine, Thames, is the fastest vessel of her type now afloat. According to the *London Telegraph*, the hull of the vessel is of immense strength and she could probably dive to 400 feet without danger. The Thames is a submarine de-luxe with many novel devices. She has facilities to render her habitable and healthy in tropical waters and her safety equipment includes two escape hatches and a telephone buoy which can be released from inside in case of emergency. Built in 1929, the Thames was commissioned last June and completed her trials recently.

This new undersea boat has a displacement of 2165 tons on the surface and 2680 tons when submerged. She is 345 feet in length and has a breadth of 28 feet. Her 10,000 h.p. Diesel engines drive her on the surface at 22½ knots. Her armament is powerful, consisting of a 4.7-inch gun in a revolving turret and six torpedo tubes all of which are mounted in the bow. Her two engines of 10 cylinders each are the product of experiment by the Admiralty laboratories and the builders, Messrs. Vickers Armstrongs, Ltd. At full power they run at 405 r.p.m. and attain a speed of more than 24 miles an hour.

This super submarine is a powerful adjunct of His Majesty's Navy and will, no doubt, have a marked effect on the efficiency of that great organization. The submarine in naval warfare is akin to the tank on land and just as this new model will have its important bearing on the use of seapower, so also the tank in its belated development will modify older conceptions of land battle. We cite the trials of the Thames as an example of engineering design applied to naval equipment because it indicates what is to be expected of all mechanical development when applied to defense purposes. Not that we envision tanks equipped with torpedoes but the constant application of automotive engineering to tank requirements during the breathing spell of the past fifteen years leaves the Mark VIII and the Renault almost where the Thames leaves the Lake and the Holland Plunger. The latter, it will be recalled, was propelled by steam on the surface and an electric motor when submerged. Holland himself was dissatisfied with the design and returned the funds advanced by our Navy Department. "The Holland" type, a later design made its appearance in our Navy in 1900 and in the British Navy in the same year. Twenty-five years of improvement have accomplished wonders. It will be the same on land as it is on the sea and under it.

The tragedy which has befallen our Nation in the Akron disaster with its priceless loss of lives will no doubt renew debate as to the value of dirigibles for national defense purposes. The scouting value of this type of craft was proved in maneuvers last year off the Virginia Capes. But for ultimate worth, the disadvantages to be taken into consideration seem to indicate quite conclusively that other types of craft are the safer choice. Great Britain wisely spends for the Thames; she has already abandoned the mammoth scouting dirigible.

What Price Arms Embargo?

An Editorial

THE Foreign Affairs Committee of the United States House of Representatives has approved the McReynolds joint resolution known as the arms embargo legislation. The instrument vests power in the President to declare an embargo on the shipment of arms and munitions of war to foreign countries when "in any part of the world conditions exist such that the shipment of arms and munitions of war from countries which produce these commodities may promote or encourage the employment of force in the course of a dispute or conflict between nations." Under the resolution the Executive, after obtaining the coöperation of such other governments as he deems necessary, is empowered to proclaim it unlawful to export or sell for export any material of this classification except under such limitations as may be prescribed.

The dangers which lurk in this legislation, if enacted, and in its possible application have already been discussed in these pages. Opposition to such a policy does not rest on fear that any President will use this sweeping power injudiciously. Well founded objection to this sweeping provision exists not only on the score of the national defense but, equally important, on the grounds of international polity. Cogent argument against the resolution on the latter phase was presented before the Committee by Hon. John Bassett Moore of New York, formerly a member of the Permanent Court of International Justice at The Hague and by Prof. Edwin M. Borchard, Professor of International Law at Yale University.

JUDGE MOORE'S statement was particularly enlightening. He combated the views and policies of former Secretary of State, Henry L. Stimson, who was an ardent sponsor of the arms embargo legislation and who contended that in the next war there could be no great neutrals. "As a life-long student and administrator of international law I do not hesitate to declare," Judge Moore, himself a former Assistant Secretary of State, said, "the supposition that neutrality is a thing of the past to be unsound in theory and false in fact." "The United States has always been a world power," he said. "It acted as a world power when, on the outbreak of the French Revolution, George Washington, with Thomas Jefferson as his Secretary of State, proclaimed our neutrality. It acted as a world power when it suppressed the Barbary pirates and in 1812 it went to war in defense of neutral rights." As to the joint resolution itself, the eminent international lawyer said, "I can only suppose that the present extraordinary agitation is due to the misleading and somewhat deafening clamor of those who, in the name of peace would confer upon the President an unlimited right to engage in hostilities. I refrain from saying an unlimited right to make war only out of deference to the profound and learned authorities who assure us that war can be abolished either by calling it peace or refraining from calling it war. This is a favorite notion with those who demand that the Kellogg Pact shall be equipped with 'teeth' in order that it may masticate alleged 'aggressors' and otherwise benignantly bite and gnaw its way to universal peace and concord. Unfortunately there are many who appear to have been infected with these confused notions which have been so industriously propagated in the United States. But judged by the course of the principal members of the League of Nations during the past ten years and by their attitude toward the hostilities lately in progress in the Far East and elsewhere such notions appear never to have had any real charm for the responsible authorities of the countries which would have been required to make the chief sacrifices in blood, in treasure and in tears."

This being so—and we believe Judge Moore reflects the opinion of an America which keeps its head in the wind and its feet on the ground and is not so gulible as the highly subsidized internationalist propaganda agencies, of which there are so many in our midst, would have us believe—what is the price to be exacted for this arms embargo legislation? If adopted and if ever put into effect the United States will have embarked upon a decidedly disadvantageous and untraditional policy and we will have, unwittingly it may be, crippled our own potentiality for defense. Either effect is bad enough, both together are unthinkable. Neutrality is a mighty precious status in time of trouble, to cast it overboard would be absurdity to the nth degree. But when to it is coupled the irreparable damage an embargo means for our own limited manufacturing facilities which are our best sure protection in time of war, then the thing is one of those pipe dreams which the peace-at-any-price boys and girls grasp at whenever some alleged expert in international relations, always of the decidedly un-American slant, sounds off.

AS an English writer, Sir Charles Petrie declared recently in *The English Review*, "Geneva has made peace rather than justice its watchword, and now it has neither. It has, somewhat blasphemously assumed that all men were equal in its sight and it is just discovering that they are not. In short, for more than a decade it has shown us how not to handle the great international problems and if our rulers learn the lesson before worse befalls we must account ourselves lucky." An arms embargo is one way how not to handle great international problems. Justice is still a vital force in the affairs of men but if peace is put first and justice second then in this case the price of an arms embargo is unthinkable. Unthinkable because justice will be jeopardized, peace will be unstable, as it now is, and American armament, unconsequential as it is in quantity will take it on the chin to its own destruction and to nobody else's good. To listen to the arms "embargo-getters" one would think the United States is the world's munitions maker. What limited exports we have are worth their weight in gold to our national defense—this is priceless experience for a few manufacturers. When we deliberately prevent this meagre competition in world markets we do an irreparable harm to our own system of national defense, we depart from an age old tradition and, sad to relate, we accomplish no earthly good except to help possibly maintain a *status quo*. This latter may bring temporary peace but never permanent justice!

All in all, it appears that some amateurs in statecraft and professionals in propaganda are determined to shove us into the treacherous arena of European politics—if not by the front door then at least by the back. Our relationship should seek a friendly adjustment of problems existing between friends. By no means, though, does a spirit of coöperation include a policy of negative force by an arms embargo. The price to be paid is exorbitant and decidedly prohibitive.

Association Affairs

Samuel Kahn, San Francisco Ordnance District Chief

MAJ. GEN. SAMUEL HOF, Chief of Ordnance, announced recently the appointment of Mr. Samuel Kahn of San Francisco as chief of the San Francisco Ordnance District to succeed Col. Bruce Cornwall who resigned several months ago.

Mr. Kahn brings to his important ordnance assignment a record of successful executive and administrative activity on the Pacific Coast. Born in San Antonio, Texas, in 1882, he received his education in the schools of San Antonio, at the University of Texas and at Purdue University, having been graduated from the School of Electrical Engineering of the latter institution in 1903. Mr. Kahn first entered the employment of the San Antonio Traction Company and the San Antonio Gas and Electric Company. In 1909 he became general manager of the Union Light, Heat and Power Company of Fargo, N. D., where he remained for two years, becoming general manager of the Appalachian Power Company in May, 1911. In January of the following year he became assistant to the vice-president of H. M. Byllesby & Co. and participated in the management of all Pacific Coast public utilities of the company. In 1913 the new District Chief took up his residence in Stockton, Calif., where he served as vice-president and general manager of the Western States Gas and Electric Company until November, 1925. During this period he also assumed the vice-presidency of the Sierra and San Francisco Power Company. He became executive vice-president of the Market Street Railway of San Francisco in November, 1925, and in the following year was elected president of that company which is the successor to the United Railroads of San Francisco operating electric and cable cars in that city and the interurban lines in San Mateo.

In addition, Mr. Kahn is vice-president and director of the California Oregon Power Company, president and director of the Stockton Terminal and Eastern Railroad Company, director of the Stockton Savings and Loan Bank, and of the Anglo California National Bank of San Francisco.

The California Ordnance District is fortunate in having at its head so worthy a successor to its former chief, Colonel Cornwall. We regard those who established this important unit of the ordnance procurement system on the West Coast much as we do those other pioneers who guided the development and responsibilities of American statehood to that area. Written large in the record is the work of two former officials of the San Francisco District, Colonel Cornwall and Lieut. Col. M. L. Brett, U. S. Army, retired. With the whole-hearted assistance of many industrialists of our Pacific states who are still identified with this movement they built a strong foundation for the ordnance preparedness structure which will be of lasting benefit. The accession of Mr. Kahn as Chief of the District assures the continuance of this necessary public service so capably begun years ago. ARMY ORDNANCE extends its felicitations to Mr. Kahn and his splendid corps of coworkers and will be privileged to aid the continued success of the great enterprise in every possible way.

New Members

THE following have been admitted to membership in the Army Ordnance Association since the last issue of ARMY ORDNANCE: B. W. Blair, Washington, D. C.; R. S. Blazer, Cleveland, Ohio; H. A. Brown, Ilion, N. Y.; J. S. Carman, Miller Field, N. Y.; J. H. Chasmar, Bridgeport, Conn.; Henry L. Hinkle, Philadelphia, Pa.; John R. Morse, New Hampton, N. Y.; Joseph B. Moore, Ithaca, N. Y.; W. R. Peel, Dallas, Texas; Nathan A. Smith, Fort Devens, Mass.; E. E. Stokes, Cincinnati, Ohio; and Robert J. Sullivan, Crum Lynne, Pa.

The following have recently become life members of the Association: Frank B. Bell, Pittsburgh, Pa.; Laurence V. Benét, Paris, France; Irénée duPont, Wilmington, Del.; Lammot duPont, Wilmington, Del.; Philip H. Gadsden, Philadelphia, Pa.; Robert P. Lamont, New York, N. Y.; W. L. Mellon, Pittsburgh, Pa.; and E. Parmalee Prentice, New York, N. Y.

Necrology

THE ranks of the Army Ordnance Association suffered irreparable losses in the death of several of its prominent and active members during the last two months. We record the passing of the following members and extend condolences to their families and friends:

Brig. Gen. C. L'H. Ruggles

SCARCELY three months had elapsed between the occasion when General Ruggles was awarded the Medal of Merit of the Army Ordnance Association and his death. Although illness prevented him from attending the 14th Annual Meeting of the Association which was held in New York City, December 21, 1932, when the medal was awarded him, still it was the belief and hope of his many friends that he would soon enjoy good health. He died of a heart attack at his residence in Charleston, S. C., on April 2nd at the age of 64 years.

General Ruggles was one of the foremost American authorities on ordnance and gunnery. During his service in the Army he achieved many technical and engineering successes for which he will long be remembered. Possibly the greatest and most far-reaching of his administrative accomplishments was the remarkable leadership he gave to the advancement of industrial preparedness. His studies, analysis and presentation of the subject are an indelible page in the chronology of munitions preparedness in the United States. His scholarly addresses which he delivered before practically all local posts of the Army Ordnance Association and other nation-wide organizations will long be remembered.

General Ruggles was born in Omaha, Neb., a son of Brig. Gen. George D. Ruggles who became Adjutant General of the Army. He was graduated from the United States Military Academy, Class of 1890, and later took the electrical engineering degree at Lehigh University. He was Professor of Ordnance and the Science of Gunnery at West Point from 1908 to 1911, and at various times in his 44 years of service commanded the Benicia Arsenal, Manila Ordnance Depot and the Sandy Hook Proving Ground. When the Aberdeen Proving Ground was decided upon during the World War to take the place of Sandy Hook, the then Colonel Ruggles was placed in charge of the new establishment which was designed and built under his command. Later he served as head of the Inspection Division of the

Ordnance Department in which capacity he served overseas with the American Expeditionary Forces. In 1923 he was appointed an Assistant to the Chief of Ordnance with the rank of brigadier general and was head of the Manufacturing Service of the department from July of that year until his retirement from active service in 1930.

President Coolidge appointed General Ruggles in 1925 a delegate to the Conference on the Supervision of International Trade in Arms and Ammunition at Geneva, Switzerland, and in 1926 he was designated to act in an advisory capacity to the National Crime Commission. He was the author of a text book, "Stresses on Wire Wrapped Guns," and of many articles on ordnance subjects and particularly on industrial preparedness which appeared in these pages and in other technical and scientific journals. In 1919 he was awarded the Distinguished Service Medal for his World War achievements. The Medal of Merit of the Army Ordnance Association awarded him last year bore with it the citation "For unusual accomplishment and outstanding service to the nation in the advancement of industrial preparedness as a guarantee of peace." His passing removes from the ordnance ranks an officer of high attainments and a tireless advocate of ordnance preparedness.

Lieut. Col. Alfred Fellows Masury

THE tragedy of the U. S. S. AKRON with its toll of lives was to the American Navy and the nation at large a staggering loss. Lieut. Col. Alfred F. Masury, a charter member of the Army Ordnance Association, was aboard the AKRON as a guest of Rear Admiral Moffett who also perished in the disaster. Deeply interested in aeronautics, Colonel Masury was a lighter-than-air enthusiast and he had previously flown thousands of miles in all types of dirigibles. He was aboard the GRAF ZEPPELIN on its attempted westward Atlantic flight in May, 1929, which nearly ended disastrously. He had made three flights in the U. S. S. Los ANGELES, one of which was a twenty-four hour training cruise along the Atlantic seaboard.

Born in Danvers, Mass., Colonel Masury attended Brown University and was graduated from that institution in 1903 with a degree in mechanical engineering. At the time of his death he was vice-president, chief engineer and director of the Mack International Motor Truck Corporation with headquarters in New York. He had served for many years as a member of the Ordnance Automotive Advisory Committee in which capacity he brought to the Army's mechanization and motorization problems a wealth of experience, sound judgment and energy which have had a marked influence on American progress in this field in recent years. His services, which were the measure of his success in commercial life, were always at the disposal of the department and it is no exaggeration to say that the fact of Colonel Masury's gratuitous work for American ordnance is one of the notable individual contributions to military progress in the last decade.

John F. Queeny

MR. JOHN F. QUEENY, a member of the Advisory Board of the St. Louis Ordnance District, charter member of the Association's Post in that city and Chairman of the Board of the Monsanto Chemical Works, died at his home in St. Louis on March 19, 1933. The 74-year-old industrialist was the founder of the company which bears his wife's maiden name and which under his direction became one of the leading chemical firms in the United States.

He was born in Chicago, and was active in the chemical and drug industry during his entire business career. He served as president of the Monsanto Chemical Works until May, 1928, when he became Chairman of the Board. He was actively identified with inland waterways improvements and was a member of the executive committee of the Mississippi Valley Association. Always active in civic developments, Mr. Queeny was a constant advocate of industrial preparedness. In his death not only the ordnance cause but the chemical industry, which is an important part of munitions preparedness, loses a friend and counselor, whose place in the forefront of our ranks will be difficult to fill.

V. C. Turner

MR. V. C. TURNER, Vice President and Treasurer of the Scullin Steel Company and a charter member of the St. Louis Post of the Army Ordnance Association, died in St. Louis, January 29, 1933.

Born in the Army, son of Major General John W. Turner, noted Civil War leader, and Mrs. Blanche Soulard Turner, descendant of a pioneer St. Louis family, Mr. Turner had always maintained an active interest in Army affairs, particularly the program of the industrial mobilization of the nation. Two of Mr. Turner's brothers served with distinction in the regular Army, the late Colonel Soulard Turner, Infantry and Colonel George E. Turner, retired, of Redlands, California.

Mr. Turner was educated at Williams College and became connected with the Scullin Steel Company in 1899. During the World War he was actively engaged in assisting the direction of the manufacture of munitions for the Allies undertaken by the company.

His delightful personality and true friendship will be missed by all who knew him, particularly his associates of the St. Louis Post in the affairs of which he took an active part.

Association Membership

OVER 90 per cent of the membership of the Army Ordnance Association consists of executives and engineers of American industry who are cognizant of the importance of industrial preparedness. These gentlemen, who, through affiliation with the Association are kept informed of current development of munitions, constitute a large portion of the civilian nucleus upon whom our Government will depend for the manufacture of ordnance in time of emergency. The membership qualifications are:

"Article III, Sec. 1. Full membership in the Association shall be open to all men who are American citizens and who are interested in promoting the cause of industrial preparedness, particularly in connection with the design, procurement, production, manufacture, inspection, test or supply of Ordnance material.

"Sec. 3. Student membership in the Association shall be open to all men who are American citizens and who are students in technical schools or colleges. Student members shall not vote or hold office in the Association."

The annual dues for regular members are $4.00, for student members $2.25. There is no initiation fee. Complete information will be sent to prospective members upon application to the Association, 805 Mills Building, Washington, D. C.

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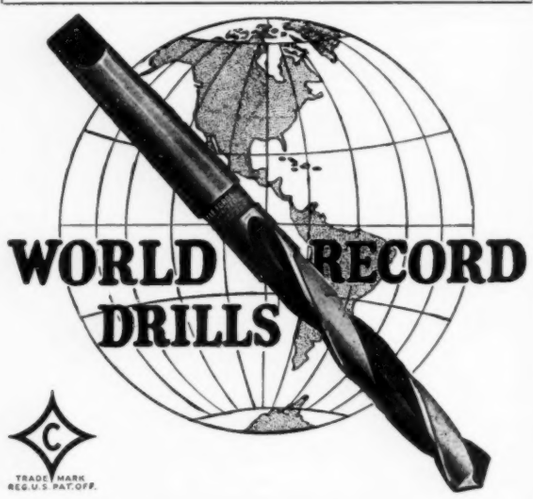

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Book Reviews

Generalship: Its Diseases and Their Cure. By Maj. Gen. J. F. C. Fuller. London: Faber and Faber Ltd. 1933. 2/6.

BRUCE BARTON, in one of his recent editorials, had this to say "In all history there are no men who have failed so often or so disastrously as generals. Yet the parks of every country are littered with their monuments. I used to see one Civil War general at public dinners in New York. His only military achievement was to blunder at one big battle and lose many men, but he was a 'general' and a 'veteran' so everybody fauned on him." The criticism may seem to be severe and may not be strictly apposite. Failures among generals are no greater in the maneuver of battle than failures among other chosen leaders in other fields of activity. Witness the current record in the realms of finance, politics, etc., etc.! But let a poor general fall down on the job, no matter what his qualifications or his effort or the extraneous handicaps put in his path, and the flood gates are turned loose on him! The diseases diagnosed by General Fuller are virulent ailments. He pleads for more head-work and indeed more foot-work by the commander on the battle field. He wants young fighting generals, men who will direct the scrimage while in it and not from the side lines. In presenting his analysis the author takes leadership in the combatant services by the back of the neck and gives it a lusty shake. Strategy and tactics of the future will (?) be all the better for the Fullerian bruskness.

"In the summer of 1921," writes the author, "I was lunching at the *Restaurant la Rue* with the Deputy Chief of the French General Staff when he told me the following story:

"At the battle of Waterloo, Colonel Clement, an Infantry commander, fought with the most conspicuous bravery; but unfortunately was shot through the head. Napoleon, hearing of his gallantry and misfortune, gave instructions for him to be carried into a farm where Larrey the surgeon-general was operating.

"One glance convinced Larrey that his case was desperate, so taking up a saw he removed the top of his skull and placed his brains on the table.

"Just as he had finished, in rushed an aide-de-camp, shouting: 'Is General Clement here?'

Clement hearing him, sat up and exclaimed: 'No! but *Colonel* Clement is.'

" 'Oh, mon général,' cried the aide-de-camp, embracing him, 'the Emperor was overwhelmed when we heard of your gallantry, and has promoted you on the field of battle to the rank of General.'

"Clement rubbed his eyes, got off the table, clapped the top of his skull on his head and was about to leave the farm, when Larrey shouted after him: 'Mon général—your brains!' To which the gallant Frenchman, increasing his speed, shouted back: 'Now that I am a general I shall no longer require them!'

"In this modest study my object is to prove, that though Clement was wrong about brains, without his courage there can be no true generalship."

General Fuller's principles of analysis are well known to readers of Army Ordnance as they are to military students everywhere. His fearlessness at times might entitle him to classification among the chronic critics were it not that he is generally right. Certainly the evidence he adduces in this book of the lamentable lack of leadership on the part of many generals of the recent past is beyond doubt. His proofs of great leadership are equally convincing. The requirements of real generalship which

he lays down—the physical, the intellectual and the moral—none will gainsay. Because health, vigor and energy are essential assets to a general in battle and because too they are the attributes of youth rather than of age, some of our preconceived notions on the subject are ready for revision.

The great Napoleon said that no general over forty-five years of age should be allotted an active command in the field and that no general over sixty should be given any but an honorary appointment. And as General Fuller points out, a study of history will show that Napoleon was not far wrong. For war-time conditions the factor is upheld by the evidence here presented because the author in an enlightening appendix gives a detailed study of the ages of 100 of the great generals of history. In the intellectual sphere of generalship the Fuller exercises that tend to prevent the grooved mind and its training in the use of thought are the author at his best. In the moral sphere Fuller calls for a remodeling of our system of discipline and of the relationship of the general to his staff.

Finally when discussing the influence of weapons upon generalship General Fuller pleads for the irradication of the horde idea. He concludes that a general who does not man a tank and control his tanks from a tank will be about as much use to his army as an admiral who, refusing to board his flagship, prefers to row about in a dinghy. The finale of the essay is "let us have done with stockyard generals and get back to the old idea which has made us what we are: that a general, however exalted by his rank, in body, heart and mind is still a soldier."

The Breech-Loader in the Service. A Description of the Breech-Loaders and Magazine Arms Used in the Service and the Different Systems Tested by the Ordnance Department 1816-1917. By Claud E. Fuller. Topeka: The Arms Reference Club of America, F. Theodore Dexter, Secretary, 910 Jefferson Street. 1933. $8.00.

THE author of this truly monumental work is the owner of some three hundred American military arms, a collection which has the distinction of containing several models not found in other well-known repositories. During the assembly of this unique, and we should add well nigh priceless, collection the author has delved into all available records for official data concerning trials, adoption and use of the various breech loaders. It is the inaccessability of these records for students and collectors which prompted Mr. Fuller to compile for ready reference some of the more important letters, reports and writings on the breech-loader in the service. This he has done in the first volume of the Arca Limited Edition, a beautifully printed book of 381 pages profusely illustrated. We recommend it in highest terms to every lover of the service rifle. It is a work of the type with which we in America are too infrequently acquainted. The book deserves to be treasured for what it contains; its author will receive the appreciative thanks of everyone who reveres the service rifle for what it is and what it stands for.

To quote from the author's preface is to initiate the reader into the documentary history which comprises this book:

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"Hall succeeded in developing the system to a point of perfection unsurpassed by even the modern methods of today, and considering the handicaps of working with the crude machines of the time, manually operated or at the best driven by water power, his work is deserving of the greatest credit.

"The many capping breech-loaders that were produced during the Civil War period present an interesting study in mechanics, and the ingenious methods employed to meet the difficult problem

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"Just as the percussion system made possible a practical revolving arm, so did the metallic cartridge with its own primer, make possible the development of a dependable magazine arm, and even some of the early systems resulted in very efficient arms, possessing many advantages over the single-loaders of the day."

John H. Hall was the father not only of the breech-loader but of the rifled arm and the interchangeable system of manufacture. His difficulties as shown in the reports cited recall the efforts of other inventors of the past and present who have come face-to-face with the routine mind of which Napoleon in his "Past and Future of Artillery" said that not only does it "scrupulously preserve like some sacred deposit but it actually opposes with might and main the most legitimate and the most evident improvements." All the more honor to Captain Hall for the beginning of a record which today reads with all the fascination of a heroic ballad. That record is a procession of the great achievements of the arms makers of America from the advent of the breech-loader in 1811 to the Springfield-Enfield of 1917. To attempt a description in the limitations of this review is impossible. We can only say that what Mr. Fuller has done is an incalculable service to the ordnance cause. His painstaking research while born of an inquisitiveness for his own recollection has added to our unassembled literature on the service rifle an historical treatise of tremendous value. He has not spared effort in making the compilation an accurate chronology neither has he economized in the cost of reproducing the book. It contains 28 plates showing a total of some 250 rifles and modifications.

Here is the recital of a record of one hundred and one years of the breech-loader and few students of the American shoulder rifle will want to be without it. The author and the Arms Reference Club of America have whetted the appetite for other volumes to come. At last, it seems, is our real ordnance literature getting under way.

Avec Joffre D'Agadir à Verdun. Memoirs of 1911-1916. By Gen. R. Alexander. Paris: Berger-Levrault. 1932. 20 francs.

A DOCUMENT of extraordinary interest for anybody concerned with the larger aspects of ordnance work is General Alexander's recently published "With Joffre from Agadir to Verdun." This is most surprising because both the title and a hasty glance at the book would give the idea that it was personal recollections in the field of tactics and strategy. In reality the second and third sections of the book are in this field but the first section, which covers the period from July 1911 to July 1914 is largely devoted to a study of matériel—mostly ordnance matériel—which is of striking interest both historically and as a guide in present questions. The author, after serving in various artillery regiments and as a professor at the École de Guerre, became a member of Joffre's staff in 1911 when the latter was designated Chief of Staff and provisionally as supreme commander in case of war. Colonel Alexander continued on this duty until he took command of combatant troops in 1916.

The book is delightful reading because the personalities that actually color and dominate the most technical affairs have not been allowed to fade out of the author's picture of those momentous times. Witness the advent of the rolling kitchens in the French Army: "The objections were numerous: most of the infantry officers were opposed to them (the rolling kitchens). They thought that the indispensable cohesion of this arm could be attained only by daily life in close contact and that it sprang from the squad around the pots and pans of the camp mess peeling potatoes and watching the soup boil. . . . After long discussions the rolling kitchen was adopted . . . to the great satisfaction of all. I don't believe that the disappearance of the 'potato circle' had any real influence on the fighting ability of the infantry."

But as to the ordnance problems of those days that are still pressing ones today. In the first place the public was more or less interested in matters concerning personnel and that part of the war preparation was fairly well provided for. But the public at large was not interested in matériel and the necessary money to balance this feature with the provisions for personnel was not forthcoming. When war came and there was an acute need for artillery, it could not be improvised. "Between the time that a certain type of artillery is adopted, usually after long studies, and the time that it actually enters the service, with its vehicles, spare parts, accessories, and ammunition, years have passed." Development was slowed up by a fear of too many types and too complicated service of the piece by the soldier but the war showed that the efficiency of the many new pieces far outweighed such disadvantages.

Hostility toward private manufacturers delayed the adoption of a suitable machine gun for a long time. Finally, years after the Hotchkiss Company had offered its gun, the Saint Étienne was adopted.

The machine gun at long ranges and the hand grenade at short ranges dethroned the rifle and the old rifle with improved ammunition was altogether adequate. Small arms ammunition production was no difficult problem especially since the workers were largely women who were not effected by the general mobilization. But with artillery ammunition, required in heretofore undreamed of quantities, it was entirely different—"infinitely slower and more difficult to manufacture, requiring in addition to a large number of highly trained workers, big factories and enormous amounts of expensive materials." The question of the proportion of shrapnel to high explosive shell brings up an anecdote replete with both the technical and human interest which we have heretofore indicated. The manufacturing service put the question up to Colonel Alexander as a member of the staff of General Joffre. Colonel Alexander replied "Mon général, I agree with you, we must have more shell, but what should be the proportion? The question is embarrassing; we could consult the oracles: the War Council, the Army General Staff, etc."—"If we start that way," replied General Mengin, the Director of Artillery, "we'll never get done. I have got the appropriation arranged and I want to issue work orders as soon as possible." "Very well, mon général, give me twenty-four hours to think it over," replied Colonel Alexander. The next day after having talked the thing over with General Joffre and several artillerymen of the faculty of the École de Guerre, Colonel Alexander told General Mengin that one half of the 75-mm. ammunition ought to be high explosive. "This proposition was adopted without other formalities." How many momentous decisions have thus been quietly made in the knowledge that the "oracles" would take too long!

What Is The Territorial Army? By Col. G. R. Codrington. London: Sifton Praed & Co., Ltd. 1933. 4/6.

ONCE again our British brethren have scored a very decided success by publishing this volume. The success is all the more pronounced when the American reader recalls that the Territorial Army is to the military establishment of Great Britain what our National Guard is to that of the United States. Nothwithstanding our valuable National Guard literature which is so well kept current through the medium of the many state publications this reviewer feels that the estimate is correct: we have in this country no such comprehensive outline of the purpose and functions of our organized militia. Gen. C. H. Harington presents a foreword in this book which heralds the volume as a solution of the problem of helping the Regular understand the Territorial so that he may gain the confidence of the latter. Granting the possible necessity for such a vehicle, the American reader will view it in a much more comprehensive way.

Not since Mr. Harold Baker's book on the Territorial Force, written at the request of the then Secretary of State for War, the

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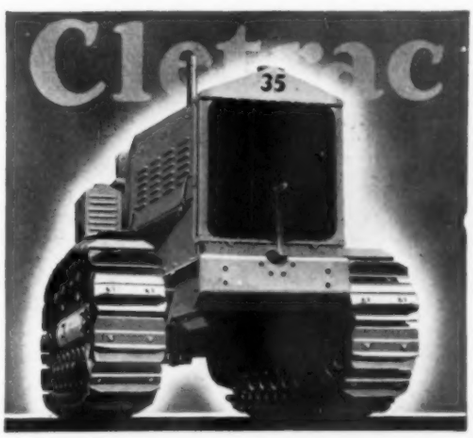

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Right Honorable R. B. Haldane in 1909, has an analysis of Britain's civilian soldier organization been so clearly presented. The Territorial Force was created in 1907 by Mr. Haldane. It was a reformation of the auxiliary forces based on an organization of a Home Defense Army made up of divisions paralleling those of the Regular Army and complete in themselves. The Act of 1907 provided a unified system of administration, training and terms of enlistment for the entire auxiliary force. What this plan meant for the Regular Army is clearly written in the record of 1914-1918 when a complete Army for Home Defense was at hand enabling the liberation of the Expeditionary Force.

The Territorial Army as it now exists is raised on the authority of the Territorial Army and Militia Act of 1921. The distinction is more than one of name. Formerly there were two distinct organizations, a Regular Army producing an expeditionary force and a Home Defense Army. Now there is but one British Army consisting of a whole-time professional portion, the Regular Army, and a second line portion, the Territorial Army.

Colonel Codrington's study gives a complete picture of all phases of territorial administration. He outlines the methods used in the organization of units and supply of personnel, finance, conditions of service, training and finally what he calls "the territorial spirit." Until some equally competent observer states the case for the National Guard here as Colonel Codrington has done for the T. A.'s there is a prominent unoccupied space on the shelves of American military literature.

Army Engineering. By Col. William A. Mitchell, U. S. Army. 3rd Edition (Revised). Washington: The Society of American Military Engineers. 1933. $3.00.

THIS is a recent revision of the well known textbook used at the United States Military Academy. Previous editions have won their laurels among the military profession and the current edition which is brought to date is both timely and informative.

The text is a clear and concise exposition of the application of engineering principles to the duties of the Army officer. It contains chapters on military mapping, shelters, roads, railways, bridges, fortifications, etc., and concludes with an informative discussion of the work of the Corps of Engineers.

As a handbook of information, particularly inasmuch as the chapters are followed with problems, this attractive volume should have a much wider use than that for which it is primarily intended. It presents in simple style and with ample illustrations the fundamentals of military engineering a knowledge of which is essential to all branches of the military profession. Those who are connected with special phases of engineering, such as the civil and mechanical, can ill afford to be without this handy text.

The Index to Army Ordnance, Volume XII, is now available. Copies, free of charge, will be furnished upon request.

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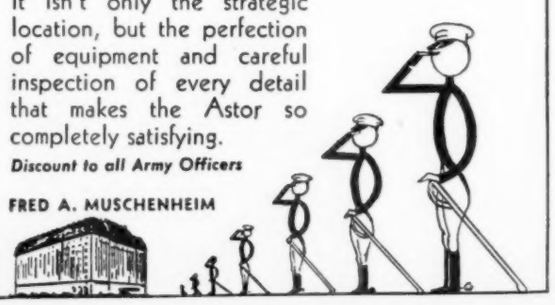
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